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BLOOD-SUCKING INSECTS OF FORMOSA.

Part 1.

TABANIDAE (with Japanese Species).

INTRODUCTION.

More than 20 years have elasped since the epoch-making discoveries, in the aetiology and mode of dissemination of some of the most formidable diseases threatening human life and progress in the Tropics, and which have naturally produced widespread interest in the proved or potential living carriers of pathogenic micro-organisms. After which there came a demand for further knowledge concerning the life-history, bionomics, and structure of the suspected disease-carriers, in order to determine the conveyance or non-coveyance of certain disease, by means of insects and their allies, and the methods of their extermination or destruction.

Entomology has thus become an accessory science, in some of its branches, to parasitology, a knowledge of the insect and of the conditions governing its existence being an evident necessity for the proper study of the parasites which it harbours. It was soon recognized, too, that insects are not only capable of acting as the intermediate hosts of protozoal parasities inimical to man and animals, but that they also become of medical and veterinary importance.

In Europe, America, Africa, and India, there are many students of medical and veterinary Entomology, specialized branches of the study of insects, but with a very few exceptions, there are almost none in Japan. For the last five years, the author has had a great interest in the study of insect from this point of view, he had had, however, but little knowledge of it as he could not spare sufficient time. In the last year or two his special attention has been paid to the number of species of Blood-Sucking-Insects, occuring in our Islands especially in that of Formosa, their distribution throughout the world, their

structure and physiology, their relation to man or domestic animals, their food, method and time of feeding, as well as their life-histroy; at the present time, however, he has little to state, except concerning the systematic study of Tabanidae.

Most of the blood-sucking insects of our Islands belong to the same Families as those found in the Paraearctic and Oriental regions, but some of them might be confined to the our Islands, such as the genus *Isshikia* (n. g.) of Tabanidae.

In the present work, attempt has been made to provide technical descriptions in detail of species of Tabanidae only, as many students might often confuse two or more species, as all the species are not well known among the students of medicine, or even entomologists. The terminology used in this paper is probably incorrect from a morphological point of view, but the terms mostly used by Verrall, are retained to avoid confusion.

The author is pleased to have this opportunity of expressing his sincere thanks to those who with unfailing courtesy, have helped him for several years by sending specimens. His acknowledgements in this direction are due particularly to professor Dr. S. Matsumura (Rigaku-hakushi), Dr. S. Isshiki, Mr. T. Okuni, Mr. M. Maki, Mr. T. Oshima, and Mr. S. Inamura. The author is well aware of the amount of time and trouble which these gentlemen must have expended on his behalf. Mr. J. Sonan, and Mr. T. Okuni have also helped him in the preparation of specimens and in coloured drawings respectively. His most cordial thanks are due to Hon. Dr. M. Takada, director of the Agricultural Experiment Station of the Formosan Government, and Dr. S. Suzuki, acting director of the Station. for their kindness in publishing this paper. The author must also render grateful thanks to Dr. C. J. Gahan, Keeper of the Entomological Department of the British Museum (Natural History), London, for giving him free access to the collections.

November 5th, 1918.

TABANIDAE.

In the Japanese Islands, as elsewhere, the horse-flies or Tabanids, owing to the size of many of the species, are the most formidable in appearance, of all the blood-sucking insects. Indeed a large female of *Tabanus chrysurus*, Loew, measuring over an inch in length, with a wing expense of nearly two inches, is exceeded in size by very few exotic species of this family, and frequently excites the surprise of those who are not entomologists, when they learn that it is really a Japanese insect.

The horse-flies, which are world-wide in their distribution, are also among the largest of all families of Diptera, the total number of species described at the end of the year 1915 being no less than 2200. In the Japanese Islands there are fifty-six recognized species belonging to the genera *Haematopota*, *Therioplectes*, *Atylotus*, *Tabanus*, *Isshikia*, *Chrysops*, *Corizoneura* and *Silvius*; I believe we should find more species if they were carfully collected through the Islands.

In appearance the *Tabanidae* are mainly bulky-bodied flies, with a large head (except in the genus *Corizoneura*), which is convex in front and concave or flattened behind. The head is almost wholly composed of the eyes: in the male the latter meet together above, but in the female they are separated. Most of the males have usually an area in the upper portion of the eyes, varying in extent according to the species, composed of larger facets than those below. In life the eyes usually exhibit golden green or purple markings, which are of value for the identification of species, and are especially brilliant in the case of the females of *Chrysops* and *Haematopota*, which posses probably the finest eyes of all insects. After death, however, the colour of the eyes rather rapidly changes to a dull brown or

brownish-black, until scarcely a trace of the markings remains.

In front of the eyes project conspicuously the three-jointed antennae, and below the head in all the Japanese forms, except the *Corizoneura yezonensis* (n. sp.), depends vertically the fleshy proboscis, which encloses the piercing mouth parts. The palpi, which lie one on each side of the proboscis, are swollen and fleshy, and differ in shape according to sex.

The body is clothed with short hair, and totally devoid of the large bristles known as macrochaetae. In the colouration as in the shape of the body horse-flies throughout the world show remarkably little variation, and the Japanese species are consequently very similar in appearance to many of those belonging to the same genera found in Europe, India and elsewhere. Some shade of brown or black is the most frequent hue, though the abdomen is often lighter or exhibits lighter markings. The wings, which, when the insect is at rest, diverge at the tips or are somewhat tectiform, have in the case of *Chrysops* and *Haematopota* characteristic markings.

Horse-flies may be met with throughout the summer in fields, open spaces in woods, by country roadsides, or sometimes in open rooms of Japanese houses. The edges of woods are the favourite haunts of certain species, and when resting in such a place on a hot day, one may frequently notic a *Haematopota* or two or a specimen of one of the smaller species of *Tabanus*, crawling with much deliberation over one's coat and making preliminary investigations with its proboscis; the outdoors of farmers' houses which are isolated in the fields are also a good place for finding all our species of the genus *Chrysops*, as their females, one or two sometimes more, very often alight on the back of one enjoying the evening breeze. The males do not suck blood, and certain species of them may occasionally be met with on flowers or sometimes hovering in the air. The species of *Chrysops* and *Haematopota*, and the smaller species of *Tabanus* are remarkable for the quietness which they alight on their victims, the

sharp prick of the bite being often the first intimation of the presence of the fly. The larger species of *Tabanus* betray their approach by their deep hum. When one operation of sucking blood has commenced, horse-flies, like other blood-sucking *Diptera*, especially *Culicidae*, may easily be captured or killed. Owing to the size of the *Tabanidae*, the wound inflicted by the mouth-parts of many of the species is especially severe. Anyone who has seen *T. trigonus* attacking horse, or *T. exoticus* attacking cattle, must have noticed the large drops of blood that exude and trickle from the spots bitten by the flies. Among domestic animals, however, horses and cattle are not the only victims, for in Formosa mules and buffaloes suffer severely, while in other countries, camels and elephants are known as the usual victims. Wild animals are similarly tormented, as the late Sir Sameul Baker states that herds of game were retreated from the South before the attacks of the several species of *Tabanus* and *Pangonia*; among the savages of Formosa it is well known that certain species of deer sometimes suffer from the biting of certain species of *Tabanidae*. In regard to the attacks of horse-flies upon human beings, abundant though certain species such as those of *Haematopota* occasionally are in the Japanese Islands, we have to turn to European records in order to understand how serious a pest these flies may become owing to their extraordinary blood-thirstiness. Thus, according to Portschinsky, in the Gdov district of the Petrograd Government, in Russia, horse-flies in summer are so excessively numerous and blood-thirsty, that agricultural operations have to be carried out by night; while in parts of Siberia, such as the shores of the river Om, settlers have been compelled entirely to abandon the zone infested by these flies.

The horse flies are known as a suspected vector of certain diseases of both human beings and animals, and at the present time we are well acquainted with many insect vectors of diseases, among which is well known that of *Trypanosoma evani*, which causes Surra of horses, mules and camels, and transmits from one to another by *Tabanus*

mlokosiewiczi, and Loa Loa, causing Calabar swellings of man, by *Chrysops dimidiata*, as well as that of *Bacillus anthracis* might be conveyanced by *Tabanidae* and infectious anoemia of horses might be transmitted by several horse-flies.

We have no idea about the life-history of our horse-flies, but we have some knowledge of certain species occuring in other countries. The females deposit their spindle-shaped brown or black eggs closely packed in rounded or flattened masses, which are attached to the leaves and stems of rushes or other smooth surfaces over water or wet ground. The larvae are whitish soft-bodied grubs, and are found in water, in earth, or in decaying wood. In shape they are cylindrical, tapering at each end, with a small retractile head, and with the first seven of the eight abdominal segments each encircled near its anterior margin with a ring of fleshy protuberances, of which there are two transverse dorsal, one lateral on each side, and four rounded ventral ones. It is generally known that house-fly larvae are carnivorous, preying upon beetle larvae, snails, worms, etc.; in my observation at Ako in Formosa (May, 1912) it is noticed that a larva of an undetermined species of *Chrysops* fed on a larva of *Schoenobius incertellus*, Walker, which was in a half-decayed paddy stem. The pupa which is not unlike that of a *Lepidopterous* insect, remains stationary in the earth or water.

Tabanidae are sometimes preyed upon by robber-flies; thus at Ako in Formosa, on May 15th 1912, the late Mr. I. Nitobe took a female of *Microstylum oberthuri*, Wulp, feeding upon a male *Chrysops sinensis*, in the southern part of Formosa, from May to July we may often meet with males of many species of *Chrysops* and *Atylotus*, and of the small species of *Tabanus* being the prey of large robber-flies, such as *Microstylum*, but there is no example of the female horse-flies being attacked by *Asilidae* flies. In other countries, it is noted by Austen that *Machimus atricapillus*, Fl., feeds upon that male of *Chrysops caecutiens*, Linn. In one case I met in Formosa, the female of *Chrysops*

dispar becomes the prey of a certain spider, hanging from its web. According to Dr. D. Sharp, horse-flies are also a favorite food of the fossorial wasps of the family *Bembecidae*, but I have no such record from our Islands up to date; while in the Island of Oshima (Kagoshima-Ken) I met in this summer the fact that many of *Vespa japonica*, Sauss., were hunting the females of *T. okinawanns*, some of them being eaten their head, wings or abdomen.

We have, up to the time, no parasitic *Hymenoptera* of the eggs of horse-flies, there are two, however, found in other countries, *Phanurus tabanivorus*, Ash., in Illinois, and *Phanurus* (*Telenomus*) *tabani*, Mayr., in Austria.

The genera and species of *Tabanidae* occuring in Japan including Formosa and Sakhalin, are as shown in the following table:

List of Genera and Species known up to the present time, showing their Geographical Distribution.

Species \ Localities	Hokkaido.	Honshu.	Shikoku.	Kiushu.	Okinawa.	Formosa.	Sakhalin.	Other Countries.
1. *Silvius formosiensis* Ric.						:		
2. *Silvius dorsalis* Coq.	:			:				
3. *Corizineura yezoensis* n. sp.	:							
4. *Chrysops mlokosiewiczi* Big.		:	:	:		:		Yunnan, Tyogosan Isd., China, Caucasus.
5. *Chrysops dispar* Fab.						:		Asia Min., Ceylon, India, Burma, Java, Sumatra, Amran, Malay, S. China.
6. *Chrysops sinensis* Walk.						:		China.
7. *Chrysops suavis* Loew.	:	:	:	:				Siberia.
8. *Chrysops basalis* n. sp.	:	:						
9. *Chrysops sakhalinensis* Plk.							:	
10. *Chrysops nigricornis* Mats.							:	
11. *Chrysops japonicus* Wied.		:	:	:				Amur.
12. *Haematopota tristis* Big.	:	:						
13. *Haematopota sakhalinensis* n. sp.							:	
14. *Haematopota formosana* n. sp.						:	:	
15. *Haematopota rufipennis* Big. ?		Japan.						
16. *Therioplectes tarandinus* L.	:					:	:	Europe, Siberia.
17. *Therioplectes hirticeps* Loew.	:						:	
18. *Therioplectes tropicus* Panz.	:	:					:	Europe.
19. *Therioplectes distinguendus* Verr.	:						:	Europe.
20. *Atylotus rusticus* Feb.		:						Europe.
21. *Atylotus fulvus* Meig.	:	:						China, Europe, North Africa.
22. *Atylotus bivittatus* Mats.	:	:		:		:		
23. *Atylotus* (?) *negativus* Ric.						:		Hongkong.
24. *Atylotus* (?) *angusticornis* Low.		Japan.						
25. *Tabanus kotoshoensis* n. sp.						:		
26. *Tabanus arisanus* n. sp.						:		
27. *Tabanus sapporoensis* n. sp.	:	:						

28.	*Tabanus quinquecinctus* Ric.						:		Burma, India.
29.	*Tabanus sexcinctus* Ric.						:		Malay States, India.
30.	*Tabanus bicinctus* Ric.						:		
31.	*Tabanus fulvicinctus* Ric.				:		:		
32.	*Tabanus iyoensis* n. sp.			:	:				
33.	*Tabanus humilis* Coq.		:	:	:				Europe, North Africa, Asia Minor.
34.	*Tabanus cordiger* Meig.		:		:				
35.	*Tabanus fulvimedioides* n. sp.		:	:	:				
36.	*Tabanus aurotestaceus* Walk.						:		Tongking, China.
37.	*Tabanus abbreviatus* Big.						:		India, Malay States, Java.
38.	*Tabanus indianus* Ric.						:		India.
39.	*Tabanus okinawanus* n. sp.				:	:			
40.	*Tabanus sapporoenus* n. sp.	:							
41.	*Tabanus mandarinus* Schin.	:	:				:		China, Hongkong.
42.	*Tabanus amaenus* Walk.	:	:		:		:		China, Hongkong.
43.	*Tabanus takasagoensis* n. sp.		:	:	:				
44.	*Tabanus crassus* Walk.						:		East Indies, India, Hongkong.
45.	*Tabanus fuscicornis* Ric.						:		
46.	*Tabanus sauteri* Ric.						:		
47.	*Tabanus sanguineus* Walk.						:		China Malay States, Burma, Siam, Assam, Sumatra, Java.
48.	*Tabanus miyajima* Ric.		:	:	:				
49.	*Tabanus exoticus* Ric.						:		
50.	*Tabanus trigonus* Coq.		:	:	:				
51.	*Tabanus rufidens* Big.	:	:	:	:				
52.	*Tabanus coquilletti* n. n.	:							
53.	*Tabanus fulvimedius* Walk.						:		Bruma, India.
54.	*Tabanus chrysurus* Loew.	:	:	:					
55.	*Tabanus birmanicus* Big.						:		India, Burma, Malay.
56.	*Tabanus perakiensis* Ric.						:		Malay Sates.
57.	*Tabanus formosiensis* Ric.						:		
58.	*Tabanus candidus* Ric.						:		
59.	*Tabanus pallidipectoratus* Big.						:		Saigon, Tonking.
60.	*Isshikia japonica* Big.		:						
	Species occuring each localities.	18	22	12	16	1	30	8	

The above are based mainly upon my own study, supplemented by those of Ricardo, Matsumura, Coquillett and others. It seems to me highly probable that further study will bring out new forms, and make our knowledge on the distribution of our *Tabanidae*, much more comprehensive that it has been attained hitherto.

Table of the Japanese Genera of Tabanidae.

I. Hind tibiae with apical spurs; ocelli usually present .....
.....Subfam. PANGONINAE.

2. Second antennal joint almost as long as the first; wings with conspicuous black bands; frons of the female with a callus ...
.....*Chrysops* Meig.

22. Second antennal joint distinctly shorter than the first; wings without black bands or markings.

3. Third antennal joint with 8 annulations, of which the first is broad and short, being not much longer than broad; frons of the female without any tubercle or callus.....
.....*Corizoneura* Rond.

33. Third antennal joint with 5 annulations, of which the first is very long and hardly broad; frons of the female with or without a callus.....*Silvius* Meig.

II. Hind tibiae without any spurs; ocelli usually absent .....
.....Subfam. TABANINAE.

2. Third antennal joint dilated near its base and with a distinct basal angle or process above, and with four subsequent annulations.

3. Basal process of third antennal joint short or obsolete at most not reaching the end of the first annulation.

4. Eyes pubescent.

5. Ocelligerous tubercle more or less distinct .....
..... *Therioplectes* Zell.

55. Ocelligerous tubercle absolutely absent.....

. . . . . .*Atylotus* Ost-Sack.

44. Eyes bare; ocelligerous tubercle absent . . . . . .*Tabanus* Zell. (s. s.)

33. Basal process of third antennal joint unusually long, at least reaching over the first annulation . . . . . .*Isshikia* Shir. (n. g.)

22. Third antennal joint dilated near its base, but without any process or angle, and with three subsequent annulations . . . . . .*Haematopota* Meig.

Subfam. **PANGONINAE.**

Ocelli often present, and the ocellar tubercle usually present. Proboscis sometimes porrect and then sometimes exceedingly long (*Pangonia*, *Diatomineura* and *Dorcalaemus*). Eyes in life, brilliant liquid green, and in *Chrysops* with purple spots or markings; upper and anterior facets often enlarged. Antennae varying from an absence of a dorsal process near the base of the third joint to that process being exaggerated into a long curved spine-like one (*Dicrania* and *Lichelacera*).

Wings very varying in venation, as the first posterior cell is often closed and sometimes even a long distance before the wingmargin (but in our fauna never closed), while the fourth posterior cell is sometimes contracted; small cross-vein sometimes almost absent, though it is always present in Japanese species.

Legs with apical spurs on the hind (as well as the middle) tibiae, touch-hairs usually indistinct, but sometimes dense and almost brushlike.

Abdomen varying from somewhat tapery to very stout and rounded; often with conspicuous yellow markings.

Up to the present time we know of only three genera and ten species in Japan, including Formosa and Sakhalin. The Japanese species of this subfamily are usually attracted by flowers, but the

females of the *Chrysops* are, of course, blood-suckers, while the feeding of the males is not known. The species, *japonicus* and *mlokosiewiczi*, are very often found on the body of horses, and *suavis*, *sinensis* and *dispar* on cattle.

I. Silvius, Meigen.

Syst. Beschreib., II, p. 27, 1820.
Ctenopsis, Macq., Dipt. Exot., I, p. 115, 1838.
Mesomyia, Macq., Dipt. Exot., Suppl. IV, p. 341, 1850.
Veprius, Rond., Archiv. Zool. Modena, III, p. 83, 1863.
Esenbeckia, Rond., Archiv. Zool. Modena, III, p. 83, 1863.

Middle or small-sized slightly hairy flies of yellowish colour, with usually hyaline wings. Face slightly arched under the antennae, moderately broad but extending only a little under the eyes, without any callosities; below the antennae is a transversal sulcus; a longitudinal sulcus from the end of that sulcus to a deep pit on the side of the middle part of the face; face pubsecent but not hairy; frons of the female broad and bearing on the fore part a large shining callus or without any callus; three ocelli present. Proboscis moderately produced and with large sucker-flaps; palpi shorter than the proboscis but longer than the half, and lying against it in the female. Eyes bare. Antennae somewhat longer than the head; first joint longer than the second which is so long as the width, and both apically clothed with black hairs; third joint bare and slightly upturned at the tip, somewhat longer than the two basal ones together, subulate, and with five fairly distinct annulations of which the first is long, but the last four are short, and the apical one is blunt at the tip and bears a few minute but distinct hairs and no tract of an apical style.

Thorax quadrate with rounded angles; humeri distinct, with a large rounded praealar callus between them and wing-bases. Pubescence on the disc fairly abundant especially forwards; pleurae conspicuously hairy on the upper part of the mesopleurae and on the pteropleurae

and mesopleurae; but there is no trace of bristles or long bristly hairs anywhere on the thorax or scutellum.

Wings without any markings or bands, hyaline, somewhat infumate; in life the wings are extended half open when at rest. Venation quite in accordance with the typical form of the *Tabanidae*, except that the upper branch of the cubital fork has sometimes (in *dorsalis* Coq.) a recurrent veinlet near its base; all the posterior cells open widely; anal cell slightly open or distinctly closed. Squamae somewhat large, with very slight fringes. Halteres with the knob large and almost globular.

Legs with two apical spurs on both the middle and hind tibiae; fore coxae long, slightly longer than half the length of the femora; femora a little shorter than the tibiae. Pubescence fairly abundant on both the fore-coxae and femora. Pulvilli three, distinct.

Abdomen moderately long, scarcely broader than the thorax but slightly narrowed behind, composed of seven segments; second segment longest, and the fallowing ones gradually diminishing in length; surface of the abdomen unicolor without any markings or bands. Genitalia small and usually inconspicuous.

This genus is composed of a small number of species which occur in Europe and America, and it is known to extend through Africa to Madagascar, in Asia, Asia minor, Morocco, Japan, Formosa and India, and in Australia and New Guinea. About 47 species occur in the whole world, including about six species which have been described as from oriental region; at the present time, we know only two Japanese species, but one of these has been only recently described from Formosa.

Key for Species.

1. Small-sized species, without callus on the frons . . . . . *formosiensis* Ric.

2. Medium-sized species, with a large shining callus on the frons . . . . . *dorsalis* Coq.

1. Silvius formosiensis. Ricardo. (Pl. I, fig. 1.)
(Taiwan-Hime-Abu.)

Ann. Mus. Hungarici, vol. XI, Pars 1, p. 173, 1913.

A small handsome yellow fly, with infumate large wings. Smallest species of *Tabanidae* from Japan.

Female. Frons slightly narrower than one-third the width of the head, a little longer than width, somewhat flat but not flush with the eyes, almost parallel-sided and inconspicuously broadened just above the antennae; callus entirely absent, orange yellow; pubescence on the frons somewhat brownish yellow, being longer towards the vertex and shorter towards the sides but quite absent near the antennae. Face arched, orange yellow, bearing a brownish deep pit on each side of the middle part of the face, and with a brown oblique stripe between the face and jowls; pubescence of the face yellow, but quite absent near the antennae and becoming longer towards the mouth-edge and jowls. Vertex slightly elevated at the middle, orange yellow, clothed with rather short yellowish pubescence which becomes shorter towards the middle; three rather large ocelli blackish brown and placed on each point of a triangle. Back of the head orange yellow, bearing yellowish pubescence. Proboscis yellow, slightly tinged with brown, shining on the blackish sucker-flaps, and bearing very shart yellowish pubescence except for a few brownish hairs beneath each sucker-flap; palpi, reddish yellow, lying against the proboscis and bearing a few brownish hairs, longer than half the length of the proboscis. Eyes quite bare, in life brilliant green, with coppery reflections varying according to the light but most evident about the lower part; facets almost all equal. Antennae incomplete.

Thorax orange yellow, paler towards the front part; around the stigmae and wing-bases somewhat reddish. Pubescence all orange

yellow and sloping, not at all dense on the disc and in fact rather scarce on the front part, denser and usually rather longer on the lateral parts, on the meso- and meta-pleurae, and on the upper parts of the sterno-pleurae. Scutellum orange yellow, short and broad, transverse, moderately convex at the posterior margin, with straight lateral margins, and bearing sparse yellow pubescence.

Wings large, slightly longer than the length of the body, brownish but paler towards the inner margin, with veins, stigma and costal cell quite brown. Upper branch of the cubital fork without a recurrent veinlet; first posterior cell widely open, gradually broadened towards the wing-margin; anal cell closed before the wing-margin. Squamae usual in size, dark orange yellow with yellowish fringe. Halteres large, dull orange yellow, with round brownish knobs, gradually darker towards the rips.

Legs moderately shining, orange yellow, except the tibiae and tarsi black and the apex of the femora brownish; fore coxae about two-thirds as long as the femora, and bearing yellowish pubescence; fore femora with rather abundant pubescence which is orange yellow but on the apical parts brownish; middle and hind femora with similar pubescence but slightly shorter; fore and middle tibiae furnished with blackish pubescence, the latter bearing two subequal black spurs; hind tibiae densely covered with blackish pubescence and bearing two not quite equal black spurs, which are smaller than those of the middle tibiae.

Abdomen about twice as long as the thorax, slightly broader than that but gradually narrowed towards the apex. Dorsum pale reddish yellow, but the two basal segments paler; ventre yellow, but scarcely darker towards the anal segment. Pubescence short, orange yellow, but on the last five dorsal segments with blackish hairs intermixed, and on the belly very short and rather dense.

Length: 7.2 mm.

I have only one female from Kanshirei in the prefecture Kagi.

This species probably does not occur in fields, but in mountainous districts it may be not uncommon.

2. Silvius dorsalis, Coquillett. (Pl. I, fig. 2.)

(Hime-Abu.)

Proc. U. S. N. Mus., XXI, p. 309, 1898.

Ricardo, Ann. Mag. Nat. Hist., (7), VIII, p. 292, 1901.

A middle-sized yellowish fly, with a large brown or black frontal callus.

Female. Frons about one fourth the width of the head, longer than width, somewhat elevated, quadrate, almost parallel-sided and diverging just above the antennae, greyish yellow, but mainly covered by a large polished brownish black or black callus, which is oblong, hardly reaching from the middle ocellus to above the antennae, and is distinctly elevated; a distinct transverse sulcus just below the frontal callus, the sulcus slightly angulated downwards at the middle, orange yellow on the spase between the antennae and frotal callus but at the middle part somewhat brownish in a darker specimen. Pubescence blackish, very sparse, entirely absent at the lateral parts of the two-thirds below. Vertex dull yellow, moderately convex at the middle, with three rather large brown or dark brown ocelli in a triangle, with a few blackish hairs behind the ocelligerous elevation. Face slightly arched, pale orange yellow, bearing two rather large polished brownish or blackish spots, which are occupying the deep pits on the sides of the middle part of the face, and with two fine but distinct longitudinal sulca which are reaching from the deep facial pits to the base of the antennal prominence; two oblique rather broad polished bands from the facial pits to the oral margin, at where they are hardly united each other; pubescence blackish, rather sparse, entirely absent on the middle part of the face and around the polished spots, and longest and stout on the oral part, at where a few transverse wrinckles are conspicuous. Jowls very short, clothed with rather abundant blackish hairs which are

longer than those on the face. Back of the head greyish yellow, bearing black pubescence on the eye-margins only. Proboscis rather stout, blackish brown, sparsely hairy beneath, bearing a broad similar coloured sucker-flaps clothed very few short blackish hairs. Palpi long, slightly shorter than the proboscis, lying more against the proboscis, reddish yellow or pale brown bearing a few black hairs which become longer and denser towards the base. Antennae longer than the head, orange yellow or reddish yellow, the annulate portion of the third joint brown, becoming black at the apex; first joint about twice as long as the second, stouter; second joint with an inconspicuous subsequent annulation; third joint longer than the two basal joints, bearing a very few inconspicuous fine hairs on the apical margin of each annulation, the annulate portion longer than the basal portion. Eyes quite bare, in life brilliant green, with strong coppery reflections; facets all equal.

Thorax dull orange yellow marked with three broad greyish stripes, the outer ones interrupted at the suture, each one about half as wide as the median, none of them reaching the posterior margin of the thorax and united behind together. Pleurae greyish brown, somewhat tinged with orange yellow; scutellum orange yellow, about twice as wide as it is long, posterior margin convex with very short straight lateral margins. Pubescence on the disc of the thorax very short and brownish, on the margins rather long and yellowish; the pubescence on the meso- and ptero-pleurae, and on the upper and hind parts of the sterno-pleurae, blackish and long, on the meta-pleurae rather denser and dull yellow with a few black hairs intermixed; the pubescence on the scutellum brownish yellow, rather sparse, becoming longer and much conspicuous towards the posterior end.

Wings about equal as long as the length of the body, greyish, distinctly smoky brown surrounding all veins, excepting of the lower branch of the posterior fork, and postical, anal and axillary veins, with brown costal cell, yellowish stigma and brownish veins (except

the postical vein yellowish), in a specimen almost entirely smoky, excepting of the anal area nearly hyaline, and with a very small hyaline spot in the second submarginal cell; and anal cell distinctly open; upper branch of the cubital fork bearing a rather long recurrent veinlet near the base; first posterior cell widely open. Squamae rather small, brownish yellow, with very short brownish fringe; halteres moderate in size, yellowish brown with rather large oblong blackish brown knob.

Legs pale brownish yellow or yellowish brown, somewhat polished, apices of all joints slightly tinged with brownish or blackish; forecoxae nearly two-thirds the length of the fore femora, furnished with blackish brown hairs which become less and shorter towards the apice and outerside; fore femora as long as the fore tibiae, covered with blackish pubescence which becomes much shorter and sparse towards the base and under surface, the inner margin of the apical part of the under surface bearing rather conspicuous black fringe; middle and hind femora covered with black pubescence, which is rather shorter and sparser and becomes somewhat denser towards the apex; tibiae all similar, bearing rather dense black pubescence, the middle and hind ones bearing two rather large, subequal, brown, black-tipped apical spurs; tarsi with short blackish pubescence above, and with very short yellowish one beneath, bearing conspicuous large brownish yellow pulvilli.

Abdomen broader than the thorax, nearly twice as long as the length of the thorax (including the scutellum); the dorsum dull orange yellow, slightly tinged with brownish towards the apex; the ventre brownish, somewhat paler towards the base; pubescence on the dorsum mainly black, but at the middle portion of each segment mostly yellow with black hairs intermixed, on the two basal segments very sparse, and becoming longer and denser towards the sides; pubescence on the belly entirely black, denser than that on the dorsum.

Length: 11.5-14 mm.

I have only three females from Sapporo in Hokkaido dated on

the 12th of June, 1904, and on the 30th of July, 1917, This fly is probably uncommon even in the northern part of Japan and I have no record of it from the southern part of the Island, excepting of a female from Oshima Island (Kagoshima-Ken), which is slightly larger and lighter, but it is quite the same as in the northern specimens.

II. **Diatomineura,** Rondani.

Subg. **Corizoneura,** Rondani.

Archiv. Zool. Modena, III, p. 85, 1863.

Large or medium-sized, slightly hairy flies of brownish or blackish colour, with usually hyaline or infumate wings sometimes marked with black. Face distinctly arched under the antennae, broad but extending only a little under the eyes, without any callosities; on the middle a large quadrate prominence, which bounds by very deep sulca especially at the sides; pubescence usually long and rather dense. Frons of the female without tubercle or callus but bearing the ocellgerous elevation on the vertex, usually narrow. Ocelli three; eyes usually bare. Antennae shorter than the head; first joint much longer than the second joint very short, usually wider than it is long; third joint much longer than the first and second together, with eight annulations of which the first is broad and short, being not much longer than broad, while the last one is usually conical, somewhat pointed, and bears a very few minute bristle-like hairs at the tip. Proboscis long or very long, bearing usually narrow sucker-flaps.

Thorax rather round, humeri somewhat distinct, with a small not distinct praealar callus between them and wing-bases. Pubescence on the disc usually abundant, especially towards the sides; pleurae densely hairy except on the fore part of the meso-pleurae and sometimes of the sterno-pleurae very sparsely pubescent; but there is no trace of bristles or bristly hairs anywhere on the thorax or scutellum.

Wings hyaline or distinctly smoky, sometimes with distinct markings. Venation of the normal type of the *Tabanidae*, but the

upper branch of the cubital fork almost always with a recurrent veinlet near its base; all posterior cells open. Squamae large, the alar pair extending more than half-way across the thoracal when they are against each other; thoracal pair obliquely outspread and somewhat covering the halteres; and both pairs with inconspicuous fringes, except the tuft of long hairs at the angle. Halteres moderate in size, with the almost globular knob.

Abdomen broad and short, usually a little a longer than the head and thorax (including the scutellum) together, and distinctly broader than the thorax; second segment longest and the following ones gradually diminishing in length; second or third segment broadest, near the anal apex suddenly narrowed and somewhat subpointed at the apex, sometimes gradually narrowed towards the apex; surface of the abdomen usually with transverse bands or markings, and usually bearing dense pubescence. Genitalia small and usually inconspicuous.

Legs with two rather long apical spurs on both the middle and hind tibiae; fore coxae stout and short, almost shorter than half the length of the fore femora, covering dense and long hairs; femora all fairly densely covered with hairs; tibiae with very short pubescence; pulvilli three, distinct.

This subgenus is distinguished by its broad abdomen, its eight-annulate third joint of antennae, and its frons without callus.

Corizoneura is represented by only one species in Europe, and by two or three in oriental regions, while about thirteen species occur in Africa, about four in America, and about eighteen in Australian regions. No species of this subgenus has been recorded from the northern belt of the world up to the present, but I have found a single specimen from Hokkaido in my dipterous collection, and the species undoubtedly belongs to the subgenus *Corizoneura*.

1. Corizoneura yezoensis, Shir. (n. sp.)

(Pl. III, fig. I; Pl. IX, figs. 1 & 2.)

(Marugata-Abu.)

There is no closely allied species in the world, but in apperance somewhat similar to *Diatomineura ricardoi* Hutt.

Small greyish black species, with rather short proboscis.

Female. Head nearly three times broader than its length. Frons about one-sixth the width of the head, and about three times longer than wide, parallel-sided, grey slightly tinged with yellowish, without frontal callus; two distinct longitudinal depressions at the middle part, near lateral margins, extending to the ocelligerous tubercle; an irregular transverse depression about the centre of the frons, and a fine longitudinal suicus from the transverse depression to the ocelligerous tubercle; pubescence on the frons very few and inconspicuous, greyish. Vertex grey, bearing a large somewhat triangular ocelligerous tubercle which is rather prominent and has three large yellowish ocelli; pubescence yellowish white, very sparse but slightly abundant behind the ocelligerous tubercle. Face grey, rather slightly arched with small facial prominence; pubescence mostly whitish, on the facial prominence stout and brown with yellowish white one intermixed, entirely absent just above the antennae; pubescence on both the lower surface of the mouth part and the jowls longer and softer than that on the other parts of the face, whitish and abundant, this pubescence extending half-way up to the back of the head, after which a short yellowish fringe begins, which gradually lengthens and hardly overhangs the eyes until it merges in the yellowish white hairs on the vertex. Proboscis thin and short, about equal as long as the depth of the head, blackish red brown, bearing rather broad but small dark brown sucker-flaps; pubescence very spare and inconspicuous on the lower surface, on the upper surface almost entirely absent, on the sucker-flaps rather conspicuous but very short. Antennae small, short, hardly longer than

width, sparsely covered with black rather short pubescence; second joint very small and much shorter, about twice as wide as long, bearing similar pubescence; third joint somewhat paler, about twice as long as two basal joints together, somewhat spine-like, very thin, with 8 annulations, of which the first is broadest, being longer than the second antennal joint but much shorter than the first antennal joint; the 8th annulation of the third joint about equal as long as the preceding three annulations together, bearing, a minute spur-like apical hair and a fine accessory hair, second annulation shortest, as long as two following annulations; fifth to seventh annulations equal in length, slightly longer than the second.

Thorax round, dark grey, with three broad blackish stripes separated by two very narrow whitish lines, the lateral ones interrupted at the suture and about half as wide as the middle one; humeri, prothorax, and praealar calli distinctly grey dusted; pubescence fairly abundant and suberect, mainly whitish. Pleurae grey dusted, with whitish pubescence, dense and tawny on the prothorax, on the upper and hind parts of the mesopleurae, and on the meta-pleurae; the pubescence on the ptero-pleurae rather sparse and short, and on the sterno-pleurae less scarcer than on the ptero-pleurae. Scutellum moderate in size, blackish brown but almost entirely obscured by grey dust, bearing rather sparse and short greyish pubescence, which becomes somewhat longer about the tip.

Wings hyaline, very faintly infumate, with yellowish veins, and with a distinct and long brown stigma, slightly shorter than the length of the body; the upper branch of the cubital fork without a recurrent veinlet; the first posterior cell rather narrow but widely opens; anal cell closed before the wing margin. Squamae pale yellowish white, with yellow margins at the alar pair, and the large and conspicuous pale tuft of pubescence about the angle; the thoracal pair with somewhat distinct margins and bearing a very fine almost inconspicuous fringe. Halteres brown, with blackish knob, not entirely covered

by the squamae.

Legs dark reddish brown, with dark coxae which are obscured by grey dust; fore coxae shorter than half the length of the femora, covered with whitish somewhat tawny pubescence; fore femora about equal as long as the fore tibiae, covered with short and somewhat tawny whitish pubescence on the upper and outer surfaces, and furnished with very short suberect brownish pubescence on the inner and lower surfaces, on the basal inner margin of the lower surface bearing a sparse blackish fringe; middle and hind femora covered with whitish soft pubescence which becomes sparser and shorter on the inner and lower surfaces, and is very sparsely intermixed with very short and suberect brown pubesence; all tibiae covered with very short and rather depressed blackish brown pubescence, very sparsely intermixed with very fine yellowish one; middle and hind tibiae bearing two rather long, subequal, reddish brown and black-tipped spurs at the apex of the lower surface. Abdomen large, much broader than the thorax, dull deep brown with orange yellow markings, and with an indistinct narrow greyish band on the posterior margin of each segment, the bands on the belly distinct and yellowish. The first segment of the dorsum most brownish; second segment longest and broadest, with the sides dark orange yellow, the markings irregularly tinged with blackish in the centre; third to sixth gradually narrowed but suddenly contracted at the tip, without markings but at the sides of each segment distinctly narrowly orange, pubescence short and depressed, mainly blackish brown, with yellowish one intermixed, but on the posterior margin of each segment almost shining yellowish white pubescence only. The belly somewhat darker than the dorsum, covered with short and depressed blackish brown pubescence intermixed with whitish suberect one on two basal segments and with whitish depressed one on the posterior margin of each segment.

Length: 11 mm.

Described above from only one, but well-preserved female

specimen collected by the author at Noboribetsu, on the 23rd of August, 1904. This species is easily distinguished from any other species of this genus, by its short and rather stout proboscis.

III. Chrysops, Meigen.

Nouvelle Class., p, 23, 1800.

Handsome middle-sized flies of mainly blackish colour, with usually yellow abdominal markings, and with conspicuously banded wings, and with long antennae.

Head usually broader than the thorax. Face strongly convex under the antennae, broad but extending only a little under the eyes, and with large polished black or yellowish brown facial, oral, and buccal callosities which sometimes more or less coalesce; the side of the middle part of the face bearing a deep pit below the facial cellus; face covering with sparse pubescence which is rather long. Frons of the male small, triangular, and quite bare but more or less dusted near the antennae; of the female broad, usually becoming broader towards the antennae, and bearing a large polished black callus on the fore part; vertex in the female elevated, in the male usually prominent, in the both sexes bearing three distinct ocelli. Eyes touching in the male for about the middle third of the distance between the antennae and occiput, bare but sometimes inconspicuously pubescent; in life brilliant golden, bluish green, in the male with purplish or rich brownish spots and hind margin, and these markings distinguished from each species by their arrangements; facets on the upper part enlarged in the male, and usually equal in the female. Antennae very long, usually about twice as long as the head; first joint usually very slightly dilated, and a little longer than the second but sometimes as long as that; second joint almost always with inconspicuous annulations, sometimes about equal as broad as the first joint; two basal joints clothed with black hairs; third joint somewhat longer or shorter than the basal two joints together, somewhat subulate, bare and more or less upturned at the tip, and with five fairly distinct

annulations of which the first is slightly longer than the followings together and is itself faintly annulated and is distinctly dilated near its base, but the three following ones are very short, and the apical one is blunt at the tip, bearing no trace of an apical style and shorter than the three preceding ones together. Proboscis considerably produced but about equal as long as the depth of the head and with rather large sucker-flaps; palpi about half as long as the proboscis and lying against it in the female, or directed rather upwards in the male.

Thorax almost quadrangular with the angles rounded off, but in the male almost round; humeri rather small, the praealar callosities large but very slightly convex and triangular; pubescence fairly abundant especially towards the sides, but is almost always denuded on the disc when the flies caught by net; pleurae considerabely pubescent on the upper part and on the meta-pleurae and ptero-pleurae; but there is no trace of bristles or bristly hairs on the thorax or scutellum; scutellum usually triangular with the apical angle rounded off, covered with rather dense pubescence.

Wings with blackish costal margin, and with conspicuous blackish markings, which usually form an irregular band across the wing, and which are more extended in the male than in the female, the blackish band of the wing is one of important point of specific characters; in life the wings are extended half open when at rest. Venation of the normal type of the *Tabanidae*; the four posterior cells always wide open, and not even contracted at the tip; anal cell usually closed, but sometimes slightly open. Squamae rather large, bearing very slight fringes except near the angle on the alar pair. Halteres with the knob rather large and almost globular.

Fore coxae considerably lengthened, about two-thirds the length of the femora; femora slightly shorter than the tibiae, the fore one covered with fairly abundant pubescence; middle and hind tibiae with two rather unequal apical spurs, the latter somewhat dilated; pulvilli three, very distinct.

Abdomen long, scarcely broader than the thorax but slightly narrowed behind, almost always longer than the head and thorax (including the scutellum) together, composed of seven segments; second segment longest and usually broadest, and the following ones gradually diminishing in both the length and width, with anal end usually blunt; basal part of the abdomen usually bearing conspicuous orange markings which are very different in the two sexes, if the basal markings wanted or present through the side of the abdomen there is almost no different in both the female and male. Genitalia in both sexes small and almost always concealed inside the anal segment.

This genus is found nearly all over the whole world; but it is not yet recorded from New Zealand. About seventeen species occur in oriental regions, about thirty six in Palaearctic regions, and about thirty five in Aethiopian regions, while about ninty eight have been described from the whole of America, but only one distinct species from Australian regions; at the present time we know six species in Japan (including Sakhalin and Formosa), one of these has been only recently described from Sakhalin Island by Prof. S. Matsumura, while I have described a distinct new species in this paper.

The flies almost always occur in the neighbood of water or wet places, and the females annoy cattle and human beings by their perisistent attacks.

Key for Species.

I. Abdomen yellowish with black stripes.

2. Discal cell hyaline; abdomen with four long black stripes..... ..... *mlokosiewiczi*, Big.

22. Discal cell hyaline; abdomen with black bifid stripe on the second segment, often extending to the third or fourth segment ..... *dispar*, Fab.

II. Abdomen black, whitish or yellowish at base.

2. Callosities on the face blackish.

3. Second dorsal segment of abdomen mostly yellow.

4. Second abdominal segment with two short black stripes, the posterior margin never tinged with black..... .....*suavis*, Loew.

44. Second abdominal segment on the posterior margin with a black band interrupted at the middle.

5. Second abdominal segment at the middle with a black bifid stripe, which extends from the anterior margin to the posterior margin..... ..... *sakhalinensis*, Plesk.

55. Second abdominal segment at the middle without a bifid stripe or with a very short black bifid stripe in the male..... *basalis*, Shir. (n. sp.)

33. Second dorsal segment of abdomen with orange yellow lateral spots, all the segments with yellowish posterior margins.....*nigricornis*, Mats.

22. Callosities yellowish..... *sinensis*, Walk.

III. Abdomen entirely black and shining .....*japonica*, Wied.

I. **Chrysops mlokosiewiczi,** Bigot. (Pl. I, fig. 3.)

(Yosuji-Mekura-Abu)

Ann. Soc. Entom. France (5), X, p.146, 1880.

Ricardo, Ann. Mag. Nat. Hist. (7), IX, p. 378, 1902; Record. Ind. Mus., vol. IV, p. 378, 1911.

Chrysops striatus, v. d. Wulp, Notes Leyden Mus., VII, p. 79, 1885; Catal. Dipt. South Asia, p. 66, 1896.
Rioardo, Ann. Mag. Nat. Hist. (7), IX, p. 379, 1902.
臨時馬疫調査委員會研究成績(馬政局)第二稿 Pl. VIII, fig. 10, 1914.

Chrysop siranensis, Bigot, Mem. Soc. Zool. France, V, p. 602, 1891.

The well-marked species of the Genus, easily known by the four narrow black stripes on the yellow abdomen and by the cross-band of wing not reaching beyond the postical vein in the female.

Female. Head slightly broader than the thorax. Face mainly covered by the shining pale testaceous calli, the two facial calli leaving a narrow intermediate yellowish stripe which widens out at its top just under the antennae, and which is pointed at its lower end just below the facial deep pits; at the outer sides of the bottom part of each facial callus there is a deep blackish pit, and beneath that a fairly large yellowish dusted patch which usually extends to the eye margin and consequently separates the facial and buccal calli, but the facial and oral calli are united on each side of the middle yellowish line; buccal calli shining black or blackish, very small, transverse in a denuded specimen, somewhat inconspicuous, and quite separated from the oral callus and hardly touching the eye margin; jowls below the buccal calli dusted with greyish yellow and extending right across from the lower eye-angles to the mouth margin; pubescence of the face consisting of rather long whitish hairs, which leave most of the protuberant shining facial calli bare, as well as the oral callus, though even on its part a very few whitish hairs exist; on the jowls and right across behind the mouth there are numerous longer whitish hairs. Frons nearly one-thirds the width of the head, flat and nearly flush with the eyes, covered with greyish yellow or orange yellow dust; ocellar triangle blackish or brownish and colour slightly extending back to the occiput but only at the middle; frontal callus convex, blackish, usually testaceous about the middle, sometimes entirely blackish or testaceous, transverse, with the lower margin slightly angulated at the middle, extending almost from eye to eye but not quite to the antennae because a doubly arched orange yellow dusted margin extends across above the antennae, and that colour extends all round the antennae and is connected with the middle part of the face; pubescence on the frons rather abundant,

pale yellowish, and quite bare on the frontal callus and just above the antennae. Back of the head with pale greyish yellow tomentum, sometimes very slightly tinged with greenish dust, with orange yellow or pale yellow eye margin, and the colour distinctly extending to the occiput; pubescence abundant and very short and fine, usually greyish yellow and becoming somewhat darker towards the ege margin. Vertex slightly convex, with yellowish or reddish yellow tomentum and bearing rather abundant and rather long pale yellowish hairs intermixed with blackish pubescence at the ocellar triangle. Proboscis blackish or brownish, shining but almost entirely obscured by greyish dust excepting of the sucker-flaps conspicuously shining, bearing very short blackish pubescence except for a few hairs beneath each sucker-flap; palpi usually reddish yellow especially at the basal half of the upper surface, somewhat shining, bearing rather sparse pale yellowish pubescence becoming longer towards the outer and lower surface, intermixed with a very few black hairs on the upper surface, about two-third the length of the proboscis. Eyes with the facets all equal; in life brilliant green, but rather coppery according to varying lights; occipital and hind margin with a purplish brown border which is bloadest about the lower angle of the eyes and becomes narrower towards the above; rest of the eye with four purplish brown isolated spots, of which the three near the frontal and facial margin are about equidistant from each other; the top spot transverse (when seen from above) longest, extending from the above of the frontal margin to just above the centre of the eye, and at the margin broadest and gradually narrower towards its end; the lowest spot to the bottom part of the occipital band not nearer than to the middle spot, transverse (when seen from front), arising just below the middle of the facial margin and extending just below and inside the centre of the eye, nearly straight but its lower margin curved outwards, and about two-thirds the length as the top spot; the middle spot smallest in these three, and irregularly round; the isolated fourth spot near the middle of the eye, somewhat

triangular, and slightly smaller than the middle spot near the frontal margin. Antennae nearly twice as long as the head, reddish yellow, black towards the tip; first joint a little longer and stouter than the second; second joint inconspicuously annulate; both yellow, bearing short blackish pubescence; third joint much longer than two basal joints together, subulate, conspicuously upturned at the tip, with five distinct annulations of which the basal one is shorter than the rest of the third antennal joint, and is hardly annulated, as well as it is reddish yellow with blackish or brownish or brownish apical part, while the last four are brownish black or brown, and are gradually shortened towards the tip, but the apical one is about twice as long as the preceding one and is blunt at the tip.

Thorax yellowish cinereous with three very distinct narrow blackish brown or black stripes, of which the middle one is about half broader than the lateral ones and is gradually narrowed towards the front and pointed; the sides of the disc somewhat broadly orange yellow, and the colour extending from the postalar calli to the humeri; a rather distinct fuscous stripe at the sides between the mesonotum and pleurae, extending from the above of the prothorax to the base of the wing; humeri distinctly orange yellow, moderately convex; pubescence fairly abundant and suberect, mainly yellowish but with rather numerous shorter depressed thinner hairs intermixed; the pubescence about the sides of the disc more erect, longer, moderately tawny. Pleurae black, grey dusted but yellowish above, with the yellowish pubescence dense and tawny on the prothorax, on the upper and hind parts of both the meso-pleurae and sterno-pleurae, and on the meta-pleurae; the pubescence on the rest of the pleurae sparser, shorter and paler. Scutellum somewhat semicircular, subangulate at the middle of the posterior margin, greyish yellow dusted, with an inconspicuous reddish yellow dusted patch about each side; pubescence yellowish and nearly erect, longer and denser than on the disc of the mesonotum.

Wings clear, with pale brown colouring at the extreme base

only filling the basal cells about one-fifth of their length, continued along the fore border to the apex; the cross band not reaching beyond postical vein, the outer margin convex (but in Formosan specimens quite straight or somewhat concave), extending from the apex of the stigma to the lower angle of the discal cell, and the inner margin convex, extending from the apex of the praefurca to the small cross vein and usually continued with the brownish shade on the lower branch of the postical fork along the basal portion of its upper branch; the extreme apex of the anal vein very rarely shaded; the centre of the discal cell hyaline; the base of the submarginal cell brownish hyaline; the upper basal cell about the basal two-third the length along the discal vein shaded with blackish brown; brownish colouring of the fore border at the apical portion narrow and rather inconspicuous, hardly reaching to the apex of the wings; the postical cell distinctly open at the fourth posterior cell sometimes slightly contracted at the margin of the wing; upper branch of the cubital fork without any trace of the recurrent veinlet near the base. Squamae greyish yellow with yellow margins and with scarcely any fringe, but the alar pair grey brown with yellowish fringe. Halteres brown to blackish, with yellowish or reddish brown stalk.

Legs reddish yellow and shining; fore coxae at the basal parts slightly covered with whitish tomentum, bearing rather sparse and somewhat long whitish hairs; all the trochanters, and the middle- and hind-coxae brown; femora furnished with rather fine but not very short yellowish pubescence which is intermixed with a few long brownish hairs at the outer surface of the fore femora and especially is conspicuous towards the apex; fore tibiae brownish especially towards the apex, bearing with rather dense depressed short brown pubescence with yellowish hairs intermixed, but on the inner surface mostly yellowish and much shorter; middle tibiae usually orange yellow with two short stout subequal blackish spurs, bearing yellowish pubescence with a few brown one intermixed, but at the

apical half of the outer and upper sides mostly brown pubescence; hind tibiae densely covered with rather long blackish hairs, mingled with much shorter whitish hairs especially on the inner sides, bearing two short subequal much thinner brownish spurs; tarsi of the fore legs blackish, slightly yellowish at the base, of the other legs yellowish, and slightly darker towards the apex, with very short blackish pubescence; pulvilli three, distinct, dull yellow.

Abdomen orange yellow, in Japanese specimens usually greyish black towards the anal end, and also at the sides. Dorsum with four very distinct blackish brown stripes, which are more or less interrupted at the segmentation; the two middle stripes broader than the lateral ones, usually extending from the anterior margin of the first abdominal segment to the posterior margin of the sixth segment (or to the middle of the sixth segment), gradually narrowed towards the apex; the lateral stripes sometimes much interrupted at the segmentations, extending from the second abdominal segment to the sixth segment, subequal through the length in width sometimes composed of a row of blackish spots; second segment longest and broadest, and the following ones gradually diminishing in both the length and width; the last three abdominal segements in Japanese specimen usually greyish black, and darker towards the apical one; pubescence mainly yellowish, rather dense and short, somewhat depressed on the disc, but suberect on the sides, especially on the two basal segment much erect and slightly longer; the pubescence on the blackish stripes mostly brown, but the brown one on the apical part of the stripes intermixed with yellowish hairs. Belly somewhat shining, unicolorus ochraceous, slightly or conspicuously darker toward the end, in Japanese specimens often with a row of variegated large dull brownish spots; this median spotted band extending from the basal segment to the fourth segment and gradually broadened hindwards, sometimes blackish; the last three segment usually blackish brown or black (sometimes ochraceous as in Formosan species),

bearing very narrow but rather conspicuous ochraceous posterior margin on each segment; pubescence short, whitish yellow; nearly all rather depressed, but on the two basal segment bearing rather long suberect yellowish hairs and also at the sides with similar pubescence.

Length: 9.5–10.2 mm.

Male. Usually smaller than the female, with more darker marking of the wings, and with much narrower lateral stripes of the abdomen.

Head conspicuously broader than the thorax. Face somewhat triangular, much covex, with a narrow intermediate yellowish stripe which is extending to the upper mouth edge, at where oral callus divided into two callosities; buccal calli conspicuously transverse, nearly touching the eye margin, from where it is gradually narrowed towards the mouth edge and is not reached these; pubescence very long, mainly blackish, rather sparse, on the lower parts of the face just above the buccal calli rather numerous and intermixed with a few shorter whitish hairs, on the narrow line between the facial calli very sparse, on the antennal protuberance quite bare; jowls covered with numerous long greyish yellow tawny hairs, not being extended to the lower part of the back of the head. Frons very small, triangular, quite bare, black and shining, but its lower half obscured by yellowish tomentum, and the antennal base luteous entirely covered with yellow tomentum; back of the head blackish, entirely obscured by greyish tomentum, flush with the eyes but hollowed out behind, and with a very short inconspicuous blackish posterior fringe; vertex brownish black, somewhat obscured by yellowish dust at the middle, conspicuously elevated, bearing rather sparse long blackish pubescence. Proboscis thinner than in the female; palpi shorter and stouter, conspicuously shorter than half the length of the proboscis, dilated about the middle, and elevated at right angles to the proboscis; the pubescence on both upper and outer surfaces much longer,

yellowish but conspicuously mingled with long black hairs, and the pubescence on the inner surface very short, whitish, with a very few short black hairs intermixed. Eyes quite bare, touching for less than the middle third of the distance between the occiput and the antenna; facets on the upper two-third dilated and dull yellow in death, but on the lower one thirds small and blackish with coppery reflections, the dividing line being somewhat sharply defined and running across semicircularly so that the small facets extend a long way up the back part; two conspicuous blackish or brownish spots on the yellow part, the large one narrow and transverse (when seen from above), parallel with the hind margin of the eye, extending from the blackish part of the eye to near the upper angle of the eye and gradually narrowed below, the small one between the former and the foremargin but below the middle of the long spot usually sub-quadrate or arc-like, no other spots found in dried specimens.

Antennae with much longer but fewer blackish hairs on the two basal joints; first joint conspicuously dilated; third joint usually less stout, with the four apical annulations narrowed conspicuously.

Thorax (and scutellum) yellowish cinereous, with three distinct blackish stripes of which the lateral ones are usually well-defined and broader than the middle one, and are not faded at the both ends and reaching to the posterior magin of the mesonotum; but the middle one is usually extending from the extreme anterior margin of the mesonotum to the almost middle of the scutellum, the stripe in the denuded specimens being not well-defined and about equal as wide as the lateral ones; the blackish stripes from the base of the wing-bases similar to those in the female; scutellum about the middle part of the anterior part usually brownish, and the colour sometimes extending to nearly two-thirds behind. Pubescence on the mesonotum much numerous, longer and darker, about the hind part with a very few short yellowish one intermixed; the pubescence about the sides of the disc strictly orange yellow, much denser and almost tawny; the pubescenee on the

scutellum very long, nearly erect, brownish, about the margins with a very few black hairs intermixed. Pleurae blackish, somewhat shining, slightly obscured by yellowish dust, the upper half of the meso-pleurae, the upper portion of the sterno-pleurae, prothorax, and meta-pleurae, as well as the ptero-pleurae densely covered with yellowish tomentum; the pubescence on the pleurae like in the female.

Wings slightly greyish but quite hyaline, with much darker markings; the brown fore border at the apical part well-defined, broader, distinctly reaching to the apex of the wings; the basal brown portion much wider, extending to the basal thirds of the basal cell; second basal cell at the lower third along the postical vein distinctly shaded; cross-band more extended below, hardly reaching to the margin of the wing, leaving the centre of the discal cell and large upper part of the postical cell where they are faded and somewhat clear, in the specimens from Japan very short as in the female but intensively darker, and very slightly faded at the centre of the discal cell.

Colour of legs in the specimens from Formosa as in the female, and in the specimens collected in Japan conspicuously darker, with the fore coxae and basal half of the hind femora blackish, the former at the basal half of both sides with an unwell-defined yellowish spot and beneath near the apex yellowish; the pubescence much longer and denser, the hind femora mostly short and yellowish; but the underside mainly bearing very long somewhat tawny blackish hairs, the pubescence on the hind tibiae more than twice as long as in the female and at the inner base with much fewer very short yellow hairs intermixed.

Abdomen gradually narrowed towards the apex and somewhat pointed, the colouring and markings as in the female, but the lateral stripe much narrower and almost always not conspicuously interrupted at the segmentation; in the Japanese specimens the extreme lateral margins with a narrow blackish stripe from the third segment to the apical segment, the stripe being gradually broadened behind, and the

three posterior segments being blackish but the first one at the places between the black stripes somewhat faded; pubescence mostly blackish, suberect, at the yellow portions and posterior margins of the segments with short rather dense somewhat depressed and yellowish hairs intermixed; and at the sides of two or three basal segments mingled with suberect, somewhat tawny, and yellowish hairs. Belly in the specimens from Japan bearing a conspicuous broad blackish (but faded by yellow tomentum) median band, which is less interrupted at the segmentations, three posterior segments entirely black but the first two slightly obscured by yellowish dust and the last one moderatly shining; in the species from Formosa orange yellow with brownish sixth segment and black seventh; pubescence mainly yellowish, very short, almost depressed, but at the median parts of the segments with a few long brownish hairs, in Japanese species usually blackish, much longer, and especially on the second segment bearing very few very long tawny hairs.

Length: about 9 mm.

I have one incomplete specimen of the male, collected by the late Mr. I. Nitobe at Koshun, in South Formosa. This is much paler than others, having very inconspicuous abdominal stripes, but the wings are much more smoky, and the cross-band has a zig-zag-like outer margin.

This species is easily distinguished from the other species of *Chrysops* by its four narrow black abdominal stripes.

The handsome *Chrysops* seems to be rather common in the Main Island of Japan, but is never found in the northern Islands, Hokkaido or Sakhalin. I have no specimens from the Okinawa Islands, but it is probably common there, because even in Formosa it is not uncommon, distributing from the northern part to the southern extremity. In Japan, females very often annoy horses by their persistent attacks, and it is usually believed that they are a transmitter of infectious anoemia of horses in Japan; in Formosa they usually bite the back or

belly of cattle.

I have records from Takasago, Hirosaki, Tokio, Iyo, Kioto, Oita, Miyazaki, and Kumamoto in Japan; from Horisha, Kagi, Koroton, Takao, Anpin, Tainan, Suihenkiaku, and Taihoku in Formosa, while many entomologists have records from Yunnan, Tygosan Island, China (Amoy), and Caucasus. My captures in Formosa range from the 3rd of April to the 23rd of August.

2. Chrysops dispar, Fabricius. (Pl. I, fig. 4)

(Taiwan-Mekura-Abu.)

Entom. System. Supplem., p. 567 (*Tabanus* 1798; Systema Antliat., p. 112, 1805.

Wiedemann, Dipt. Exot., p. 102, 1821; Aussereurop. Zweifl. Ins., I, p. 196, 1828.

Macquart, Dipt. Exot., I, p. 159, 1838; Suppl., 3, p. 14, 1848.

Walker, List. Dipt. Brit. Mus., I. 195, 1848; V, Suppl., I, p. 229, 1854.

V. d. Wulp, Sumatra Exped., Dipt., p. 19, 1881; Catal. Dipt. South Asia, p. 65, 1896.

Osten-Sacken, Annal. Mus. Civ. Genova, XVI, p. 418, 1882; Berlin Ent. Zeitschr., XXVI, p. 97, 1882.

Roeder, Ent. Nachricht., XIX, p. 234, 1893.

Ricado, Ann. Mag. Nat. Hist. (7), IX, p. 374, 1902; Ann. Mus. Hung., XI, 1, p. 173, 1913; Rec. Ind. Mus., IV, p. 380, pl. XV, fig. 3, 1911.

Matsumura, Thous. Ins. Japan, Addit., II, p. 384, pl. XXII, fig. 13, 1916; 大日本害蟲全書, 後編, p. 69, pl. 10, fig. 9, 1914 (めくらあぶ).

Shiraki, Tokubetsu-Hokoku, Agr. Exp. St. Govrn. of Formosa, VIII, p. 280, 1913 (めくらあぶ).

Haematopota lunatus, Gray in Griffith: Anim. Kingd., XV, p. 696, pl. CXIV, fig. 4, 1832.

Chrysops bifasciata, Macquart, Dipt. Exot., I, p. 161, 1838.

Chrysops ligatus, Walker, List. Dipt. Brit. Mus., I, p. 195, 1848;

V. d. Wulp, Cat. Dipt. South Asia, p. 65, 1896.

Chrysops semicirculus, Walker, List Dipt. Brit. Mus., I, p. 196, 1848; Ricardo, Ann. Mag. Nat. Hist. (7), IX, p. 375, 1902.

Chrysops terminalis, Walker, List Dipt. Brit. Mus., I, p. 195, 1848; V. d. Wulp, Cat. Dipt. South Asia, p. 65, 1896.

Chrysops impar, Rondani, Ann. Mus. Civ. Genova, VII, p. 400, 1875.

Rather broadly distributed and well known species, with a black bifid stripe on the pale yellow abdomen, and with well-defined cross-band, reaching to the hind margin of the clear wing.

Female. Head slightly broader than the thorax. Face moderately prominent below the antennae, partly covered with polished yellowish brown (not uniformly) calli, and the rest parts densely covered with rather deep yellow tomentum; the narrow median yellow stripe which is much broader than that in *Chrysops mlokosiewiczi*, Bigot, and widens out at its top just under the antennae, and which is reaching to an imaginate line between the very small facial deep pits which is at the outer sides of the bottom part of each facial callus; facial calli at the side above hardly touching to the eye margin, and at the upper end slightly reaching to the transverse sulcus just below the antennae; oral callus never devided by a yellow median line into two lateral ones, and outside that a fairly narrow, oblique, yellow-tomentose patch which usually extends to the eye margin and cosequently separates the facial and buccal calli, but the facial and oral calli are united, and the both together well figured like a letter V; buccal calli shining black or blackish, extremely large, round in shape, extending from the eye margin to the lower mouth-edge, and covering the mostly parts of the jowls which are covered with a witish dust only a small space near eye margins below the buccal calli. Pubescence on the face very few and short, whitish, almost inconspicuous, but at the yellow middle line and near the eye margins slightly conspicuous, especially on the former; the pubescence on the jowls (near the mouth-edge and just the below buccal calli), conspicuous, long and somewhat tawny, but not

very numerous, which becomes very shorter up the back of the head until it merges into the yellowish and brownish hairs on the vertex. Frons diverging towards the antennae with the straight sides, the upper end slightly narrower than one-fourth the width of the head, and the lower end broader than the one-thirds the width of the head, flat but hardly flush with the eyes, covered with a whitish yellow tomentum; frontal callus black and shining, transversely oblong but with doubly and slightly arched lower margin and with inconspicuously and inwardly curved upper margin, large, moderately convex, and extending almost from eye to eye but not quite to the antennae as in *Chrysops mlokosiewiczi*, Bigot, longer and less convex than that of *mlokosiewiczi*; ocellar triangle black and shining, almost trapezoidal, and nearly flush with the eyes, the hind lateral angles reaching to the upper angle of the eyes; antennal protuberance well divided by a very short median sulcus into two lateral ones, slightly convex and yellow dusted but with the margins of the cavities brownish. Pubescence on the frons yellowish, very short and sparse, excepting of both the frontal callus and antennal tubercle quite bare, on the ocellar triangle brown. Back of the head entirely black and somewhat shining, leaving narrow yellowish eye-margins, very slightly covered with a greyish tomentum, bearing short yellowish hairs near the eye-margins, intermixed with a brown pubescence at the upper part. Occiput black, very slightly covered with a yellowish dust, and bearing short yellowish hairs above. Proboscis slightly shorter than the depth of the head, rather slender, blackish brown and slightly shining, bearing a very short blackish pubescence which is much paler towards the base, and which is longer but sparser beneath the sucker-flaps; palpi a little longer than half the length of the proboscis, yellow, slightly compressed and curved anteriorly and subpointed at the tip, bearing short whitish yellow pubescence which becomes longer below the outer surface. Antennae very slender, about three times as long as the length of the head; first joint a little longer than the second, but thinner and not dilated, yellowish

brown, somewhat darker towards the tip and sometimes conspicuously tinged with blackish at the tip; second joint blackish brown, slightly thinner than the third, very inconspicuously 5-annulated; both furnished with very short blackish hairs which on the first become shorter and sparser towards the base; third joint longest and thickest, quite bare, much darker than the second, subulate, slightly upturned at the tip, with five distinct annulations of which the basal one is about equal as long as the following four annulations together, and is bearing five or six very inconspicuous annulations, while the last four are about equal in length, but the apical one much longer than the rest ones and bearing a few very short and inconspicuous hairs. Eyes with facets all equal; in death deep rather purplish black, with coppery reflections.

Thorax slightly shining, black, somewhat by a whitish dust, with two mouldy grey stripes only separated by a narrow and faint yellowish brown line, the outside of this grey stripes conspicuously darker; pubescence on the disc whitish yellow, very short and rather sparse, but on the praealar calli and on the posterior border of the disc golden yellow, exceedingly danse and depressed, with suberect paler hairs intermixed; humeri yellowish brown, moderately convex, bearing rather sparse pale yellow pubescence; pleurae blackish, slightly obscured by a whitish tomentum, but the prothorax and sternum and meta-pleurae pale golden yellow, and the upper part of the meso-pleurae slightly obscured by a yellowish dust. Pubescence on the pleurae rather sparse and yellowish, but on the prothorax and meso-pleuare moderately dense and long, somewhat tawny, and on the upper and hind part of the meso-pleurae and on the meta-pleurae much denser, golden yellow, and quite tawny. Scutellum transverse with straight convex, moderately shining, brown, paler hindwards, bearing rather sparse, suberect and pale hairs, but almost entirely bare from tomentum.

Wings clear, on the fore border from the base to the apex brown, but at the extreme base above the humeral cross-vein yellowish; basal cell with a small oblique brown band at the base; cross-band

well-defined, reaching to the inner margin but on the postical cell with a deep incision from the inner border, the clear portion usually extending to the fourth posterior cell, and very often both the centre of the discal cell and the base of the submarginal cell somewhat paler, especially distinct on the former; the inner margin of the cross-band conspicuously angulated at the point of the basal angle of the postical cell and then reaching to the end of the lower branch of the postical fork; the outer margin of the cross-band nearly straight or sometimes slightly curved inwards from the apical end of the stigma to the open end of the fourth posterior cell; upper branch of the cubital fork without a recurrent veinlet near the base but sometimes obtusely angulated; fourth posterior cell open but distinctly contracted at the margin; anal cell distinctly closed just before or at the margin. Squamae yellowish brown or brown with brown or blackish brown margins and bearing very inconspicuous fringes, but at the angle with rather dense yellowish fringe; halteres blackish brown, with the paler stalk, slightly shining but moderately obscured by a grey dust.

Legs yellowish brown excepting of the anterior trochanter, middle and hind coxae, and hind femora brown or dark brown and slightly shining; fore coxae about two-thirds the length of the fore femora, slightly tinged with brownish towards the base, bearing a few, short, yellowish hairs; fore femora covered with fine yellowish pubescence but at the outer side a few somewhat long and stout black hairs intermixed; fore tibiae slightly dilated and moderately curved, slightly darker and distinctly shorter than the femora, with numerous very short blackish hairs not intermixed with any others; middle legs paler than the others, the pubescence as in the fore legs but the black hairs on the femora much sparser, the tibiae bearing two subequal rather stout black apical spurs; hind femora at the apex only yellowish brown or reddish brown, bearing very short blackish pubescence, but on the lower surface with yellowish hairs; hind tibiae much longer than the femora, slightly darker than the tarsi, with almost entirely blackish

short hairs, bearing much shorter and rather fine subequal black apical spurs; the apical joint of all the tarsi bearing a rather stout curved specially long blackish hair and a few shorter ones at the apex above; pulvilli yellowish.

Abdomen narrow and somewhat tapering, conspicuously longer than the head and thorax (including the scutellum) together, pale yellow, gradually tinged with reddish yellow towards the apex but sometimes blackish brown at the two or three apical segments, and rarely much darker gradually towards the anal end. Dorsum moderately convex, the apical portion usually paler than the ventre; first segment pale, with posterior margin at more than median three-fifth brown; second joint very often slightly paler than the first segment, with two brown spots united at the basal one-third of the segment in a somewhat rounded angle but not reaching to the anterior margin, continued as far as the posterior margin of the third segment which is slightly reddish yellow, and is shorter than the second; the four following segments distinctly darker than the preceding one, without any markings or spots; pubescence very short, moderately depressed, pale yellow, but on the brown markings mainly brown and on the fourth segment hindwards the brown spots on the third segment with brown hairs intermixed, slightly lengthened at the sides and anal end; the sides of the dorsum narrowly brown, excepting of the first segment. Ventre very often with a narrow reddish yellow stripe which is usually conspicuous on the two basal segments but sometimes extends to the third; the two basal segments pale, but sometimes pale reddish yellow at the posterior border of the second segment; third segment usually reddish yellow but sometimes paler forewards, bearing a brown band at the posterior border, the transverse band sometimes quite interrupted at the middle; the following segments usually reddish yellow, but somewhat brownish at the apical segment; pubescence much shorter than that on the dorsum, and less numerous, almost entirely yellowish, suberect.

Length : 8.5-11 mm.

Male usually about same in size, with larger head and with darker legs. Head conspicuously broader than the thorax Frons very small, dark brown, shining but slightly covered with a greyish dust, quite bare from pubescence, with rather prominent antennal tubercle which is paler and much conspicuously dusted. Face less convex and conspicuously less produced below at the mouth part ; the intermedial yellow line broader, reaching to the upper edge of the mouth, and oral callus consequently divided into two lateral ones ; the lateral yellow bands broader, somewhat triangular and short, with much horizontal lower margin ; facial calli much darker and almost entirely black at the outer half, hardly touching to the eye-margin only leaving a very inconspicuous yellow line which is extending from the large yellow lateral bands ; buccal calli somewhat smaller and paler towards the mouth edge ; pubescence much longer and much numerous, yellowish on the facial and oral calli very short and fine, sparse, whitish, but quite bare just below the antennae ; jowls black but sometimes somewhat yellowish brown towards the mouth-edge, slightly shining but moderately covered with a greyish dust, furnished with somewhat tawny rather yellowish hairs, which become shorter and less denser at the black of the head. Vertex small, triangle, prominent, black, somewhat obscured with a yellowish dust, bearing a few long curved blackish pubescence at the sides between the ocelli especially behind, the pubescence on the centre very short and sparse ; ocelli usually ruby-red. Back of the head conspicuously concave, black, almost entirely obscured by a yellowish tomentum, furnished with very short pale hairs. Proboscis usually thinner than in the female and much shorter than the depth of the head ; palpi shorter and stouter, about half as long as the proboscis, brownish yellow at the basal joint, and elevated at right angle to the proboscis ; pubescence much longer and much numerous, on the upper surface about twice as long as that on the other surfaces. Eye quite bare, touching for more than middle

third of the distance between the occiput and antennae; facets more than two-thirds above dilated and reddish yellow in death, but on the lower about one-thirds small and blackish; the dividing line being somewhat sharply defined and running across semicircularly so that the small facets extend a long way up the back part; two conspicuous blackish spots on the yellow part of which the large one is long and transverse as in the preceding species, but much nearer to the hind margin of the eyes, the small one is usually triangular, being pointed below and reaching to the blackish part, but it is sometimes very small and inconspicuous and consequently not extending to the blackish part. Antennae similar to those in the female, but distinguished by much numerous and longer erect pubescence on the basal joint.

Thorax much shorter and somewhat rounded in shape, the pubescence on the disc very short and somewhat depressed, but intermixed with a few very fine rather very long almost erect hairs; scutellum somewhat flatty, triangular, being long sparse hairs round the margins; pleurae like the female, but somewhat densely haired.

Wings comparatively large, the cross-band with not angulated inner margin, and almost always inwardly curved outer margin; the anal cell very rarely hardly closed.

Legs much darker, brownish, but the two anterior femora, the two posterior tarsi, the basal part of the fore and hind femora, and the both ends of the middle femora, yellowish; the pubescence on the legs usually longer than that in the female, and especially on the femora numerous.

Abdomen usually shorter and somewhat paler, the pubescence usually longer and especially at the sides.

Length: about 9 mm.

This species shows very little variation in a number of specimens (14 males and 14 females) from Formosa, and two males from Hainan Island and Ceylon, from the former the above description has been made, but in one female from Horisha (10th of May, 1913) the black

bifid spot on the abdomen is extending to the fourth segment of the abdomen.

In Formosa this distinguished species is very common, through almost the whole Island from Spring to Autumn, but in the southern parts, we have very often found the flies during Winter. The male flies are found during the day time, on the lower surface of the leaves of shrubs growing on somewhat wet places and the females are found usually, attacking the cattle resting in pasture or pen, in the day time, and become active towards evening. It sometimes bites our back through thinner summer clothes, in the evening from about five to six o'clock.

3. **Chrysops sinensis,** Walker, (Pl. I, figs. 5 & 6.)

(Shina-Mekura-Abu.)

Ins. Saund. Dipt., I, p. 453, 1856

V. d. Wulp, Cat. Dipt. South Asia, p. 65, 1896.

Ricardo, Ann. Mag. Nat. Hist. (7), IX, p. 377, 1902; Rec. Ind. Mus. IV, p. 388, 1911.

Kertesz, Cat. Dipt., III, p. 197.

A robust-looking yellowish species with black median oblique spots on the dorsal segments of the abdomen, and sometimes the five apical abdominal segments appear more black than yellow as the oblique spots are very large. Thorax blackish with distinct yellowish stripes; wings with a rather peculiar narrow cross-band and with a apical spot.

Female. Head a little broader than the thorax. Frons broad, very slightly divergent below, at its narrowest part occupying a little more than one-thirds of the head, blackish (in a specimen caught at Taihoku, 1905, yellowish brown), but densely covered with a greyish yellow tomentum; frontal callus shining black or yellowish brown, large, transverse but not reaching the eyes, protuberant, its upper margin very slightly arched but inconspicuously incised in the middle; ocellar triangle slightly convex, moderate in size, covered with a scarce

yellowish dust, the remaining part of the vertex slightly shining blackish; pubescence on the frons very inconspicuous, pale yellowish, but it becomes longer and darker towards the vertex; pubescence on the occiput slight puffed out; a double arched narrow band just above the antennae orange yellow, slightly covered with a whitish yellow tomentum, which extends completely round the antennae and for its full width to the eyes, and is connected rather narrowly with the narrow whitish yellow dusted middle part of the face; this latter space points just below the upper margin of the large shining pale reddish yellow united oral callus, which is widely united with facial calli; eye-margins very narrowly yellowish grey and connected with broad yellowish band which separates the facial from the buccal calli; buccal calli rather small and moderately shining black or yellowish brown, separated from oral calli by an obscure but broad grey-dusted space. Pubescence on the face mostly very fine, whitish, very sparse, but becomes a slightly conspicuous towards the sides, a very few somewhat long sloping pale yellow hairs conspicuous on the middle part of the face, and a few long pale pubescence occuring on the jowls; back of the head a little puffed out, yellowish and bearing a very short orange yellow fringe near but not on the eye margin. Antennae longer than the two-thirds of the thorax, greyish yellow or pale yellowish brown, excepting of about the apical two-thirds of the third joint blackish brown; first joint slightly stouter and longer than the second, furnished with rather sparse short black pubescence; second joint slightly darker than the basal joint, with three very inconspicuous annulations and with somewhat stouter and longer black hairs which become conspicuous towards the apex; third joint distinctly longer than the two basal joints together, moderately upturned at the tip and with fairly conspicuous annulations of which the first is slightly dilated near the base and is longer than the remaining together, the basal annulation composed of four or five inconspicuous annulations usually blackish at the apical half, the apical annulation bearing a few very inconspicuous fine pubescence. Proboscis

stout, shorter than the depth of the head, blackish brown, slightly shining on the sucker-flaps, and bearing very short pubescence; palpi shining yellowish, stout, bearing very fine brownish pubescence, shorter than the two-third of the proboscis and moderately dilated before the middle. Eyes with the facets all equal; in death purplish black, somewhat coppery according to varying lights; marginal band and isolated spots in the specimens I have examined obscure, but these are nearly similar to those in the preceding species; eyes in life brilliant green somewhat coppery according to varying lights; occipital and hind margins with a dark purplish black border which is very slightly notched about the middle, and this border is broadest about the angle above the jowl; rest of the eye with four purplish brown isolated spots, of which the three near the frontal and facial margins are about equidistant from each other in their inner ends; the top spot transverse (when seen from above), and the largest of the three; the lowest spot rather near the bottom part of the hind band and transversely oblique (when seen from front), this spot being nearly as large as the upper spot and reaching the eye-margin; the middle spot smallest and somewhat trapezoid with a sharp inner angle and blackish; the isolated fourth one below the middle of the eye not spot but rather a band parallel with the occipital band from the front of the upper angle of the eye to below the middle of the eye, this band being narrow, gradually broadened below and with a sharp inner angle before the lower end.

Thorax robust, dull brownish black, slightly shining, with two distinct median grey white tomentose stripes which are separated by a well-defined black line and extend throughout the length of the mesonotum; the lateral stripes of the mesonotum conspicuous, moderately broad; greyish yellow, extending from the pale greyish brown tomentose humeri near the posterior end of the post-alar calli which are usually brownish; scutellum black (in some specimens dull reddish brown at the sides), densely covered with a greyish tomentum which is usually brownish at the middle of the base of the scutellum; pubes-

cence on the disc very fine, pale yellowish, becoming longer and denser at the lateral stripes, but on the humeri rather sparser and much erect; pubescence on the scutellum scarce. Pleurae black, but densely covered with a greyish yellow dust especially on the prothorax, the upper part of the meso-pleurae, and the meta-pleurae; on the upper and hind part of the meso-pleurae there is a dense very conspicuous tawny patch of long shaggy hairs, and a similar patch is almost equally conspicuous on the meta-pleurae and prothorax, but below these patches the pleurae bear only very scattered whitish yellow hairs; on the narrow lateral brownish stripes between the mesonotum and pleurae there are a very few brownish hairs.

Wings rather large with the usual brown band and apical spot; the former is rather narrow occupying about the length of the discal cell and only reaching beyond the lower branch of the postical vein, the inner margin extending from the base of the cubital vein to the base of the lower branch of the postical vein, slightly double-arched and at the end of the discal vein slightly angulated outwards; the outer margin of the cross-band irregular, extending from after the end of the subcostal vein to the end of the lower branch of the postical vein, in the submarginal cell it is moderately curved inwards, and at the cubital vein right-angled, somewhat straight from the cubital vein to near the third veinlet of the discal vein but obliquely curved inwards in the first posterior cell, and the portion from the third veinlet to near the lower branch of the postical vein nearly straight but not well-defined, oblique and somewhat parallel with the base of the upper branch of the postical vein, as it is obtusely angulate at the third veinlet of the discal vein, and then bent outwards running along the lower branch of the postical vein; the apical spot the same width throughout, only crossing the upper branch of the cubital fork at its apex; the basal brown marking rather small, occupying both the basal half of the upper basal cell and the extreme base of the second basal cell; discal cell rather short, slightly longer and

broader than the third posterior cell; fourth posterior cell contracted at the margin of the wing at where the width is about as its basal width; anal cell is usually closed at the wing-margin but in sometimes conspicuously open; upper branch of the cubital fork without any veinlet. Squamae pale brown with darker margins, and with a fairly obvious fringes; halteres blackish brown.

Legs reddish yellow, knees darker, the base of the hind femora and the four apical joints of the tarsi blackish; front coxae moderately dilated, slightly longer than half the length of the fore femora, furnished with a fairly abundant pale pubescence which becomes longer at the upper basal part; fore femora (without the trochanter) as long as the tibiae, with a somewhat sparse blackish pubescence which is usually inconspicuous but on the upper margin is fairly conspicuous and pale yellow; middle femora sometimes with an irregular blackish spot on the lower base, shorter than the tibiae, pubescence brownish, fairly conspicuous, on the lower margin there are rather abundant longer paler hairs; hind femora distinctly shorter than the tibiae, not very dilated, the basal blackish part sometimes extending near the apex in the inner surface, furnished with rather abundant yellowish pubescence which becomes longer at the lower margin; fore tibiae very slightly covered, at the middle, with very short blackish brown pubescence; middle tibiae covered with very short inconspicuous blackish brown pubescence and bearing two subequal blackish spurs; hind tibiae furnished with abundant blackish pubescence and with two black fringes of which the upper one is much conspicuous, and bearing two rather slender blackish spurs; tarsi with blackish claws and yellowish pulvilli.

Abdomen broad, rather short and gradually narrowed apically with a round apex, appearing a variable in colouring; in some specimens it is quite blackish, while in the others it is quite yellowish, in each case yellowish tomentum decorates nearly throughout the surface. Dorsum slightly convex, the apical part slightly sloping below; the two basal segments pale orange yellow, the first segment with a large

irregularly shaped blackish spot in the middle, the second segment with two chevron-like black spots not quite joining above, their bases resting on the posterior border; the remaining segments in the darker specimens almost black, with narrow yellowish or yellowish grey borders extending in the middle to triangular spots, and with a trace of a yellowish spot on each side of the third segment, in sometimes the yellowish trace not occuring; in the yellowish species the yellow colour being more expanding and on the posterior segments more extending, leaving only black spots very similar to those in the second segment but not converging so much towards each other, and the lateral reddish yellow spots conspicuously occuring on the third and fourth segments; these two segments usually having the similar but inconspicuous reddish yellow spots at the extreme sides; pubescence scattered on all over the surfaces yellowish, on the second segment it is intermixed with blackish hairs at the sides, and the pubescence on the blackish parts is mostly black. Ventre usually strongly convex but at the apex quite flat, blackish obscured by a more dense yellowish tomentum, two basal segments with the yellowish lateral markings and the remaining segments with a narrow yellowish posterior border; in the paler specimens the three basal segments almost entirely yellow and the remainings blackish with a narrow yellowish grey posterior margin; pubescence very fine, almost depressed, yellowish.

Length: 8–11 mm.

Male. Not much like the female, because of the more extensive yellow markings about the side of the abdomen and generally yellowish orange.

Head broader than the thorax. Face pale orange yellow, mainly covered with the shining pale reddish yellow calli, two facial calli leaving a narrow intermediate yellow stripe which widens out at its top just under the antennae and which also usually widens out a little at its lower end just above the mouth; at the bottom part of each facial callus there is a deep pit, and beneath that a fairly large

yellowish patch which usually extends to the eye-margin and consequently separates the facial and buccal calli, but the facial and oral calli are united on each side of the middle yellow line; buccal calli moderate in size, transverse, and hardly connected with the oral calli along the mouth-edge; jowls below the buccal calli greyish yellow and extending right across from the lower eye-angles to the mouth-margin; pubescence on the face composing of rather long brownish black hairs, which leave most of the protuberant shining pale reddish calli bare, as well as the yellow middle line and the upper mouth-margin, though even on parts of these a very few blackish hairs exist; on the jowls and right across behind the mouth there are numerous longer yellowish white hairs; back of the head black entirely obscured by a greyish yellow tomentum, flush with the eyes but hollowed out behind, and with a very short close blackish postocular fringe. Vertex brownish black, protuberant, and with somewhat abundant blackish hairs; frons small, triangular, quite bare from pubescence, shining black with a greyish yellow fore-border which extends all round the base of the antennae and joins the yellow middle line of the face, while a very narrow greyish yellow line extends down the extreme eye-margin to the large yellow patch below the facial calli. Proboscis much shorter, longer than half the depth of the head, moderately stout, blackish brown, slightly shining, the sucker-flaps bearing very short blackish pubescence except for a few hairs beneath the sucker-flaps; palpi dick and short, curved below and inwards, pale reddish yellow, shining, furnished with a short blackish pubescence which is intermixed with a few long yellowish hairs about the base, at the apex there are a very few curved black hairs, about two-thirds as long as the proboscis and moderately dilated about the middle. Antennae usual, shorter than the thorax, and stouter than in the female, first joint about as long as the second joint, somewhat conspicuously dilated especially at the basal half, pale reddish yellow, shining, bearing mixed short and long black hairs which are not very

abundant; second joint distinctly narrower and darker than the basal joint, darker towards the apex, furnished with the similar but much dense black pubescence, usually without any inconspicuous annulations; third joint much more upturned at the tip, dull black except the basal part reddish yellow, at the apex with a few somewhat conspicuous black pubescence. Eyes quite bare from pubescence, touching for less than the middle third of the disiance between the occiput and antennae; facets on the larger upper part dilated and yellowish brown or yellow in death, but on the smaller lower part small and purplish black with somewhat coppery reflections according to varying lights; the dividing line being somewhat sharply defined and running across semicircularly so that the small facets extend a long way up the back part; the large blackish purple middle spot near the upper margin of the smaller blackish lower part of the eye triangular with a flat upper margin, and between it and the foremargin but slightly higher up a smaller, second subquadrate spot, below the second spot the usual lower spot which is moderately large and transverse subquadrate, the hind marginal band not notched at any part and broadest about the hind lower angle of the eye; in the larger yellowish upper part of the eye a narrow transverse purplish brown line which extends from near the occipital angle to the middle of the large middle spot, being parallel with the upper margin, and an isolated similar coloured spot between it and the facial margin somewhat long triangular with flat upper margin and little smaller than the large triangular spot in the blackish part.

Thorax blackish, moderately obscured by a dense brownish dust, slightly shining, short and robust, in the part between the bases of wings it is broadest and is gradually but distinctly narrowed towards the anterior margin, much more shorter than in the female. Thorax with two distinct median greyish yellow or yellow tomentose stripes which are similarly separated by a not well-defined brownish black line and expanding from the anterior margin to the posterior margin, being nearly united from each other at both the ends; the lateral

orange yellow stripes on the sides usually broader than in the female; pubescence on the disc yellowish but varying to brownish, rather long, numerous but not obscuring the ground colour at all on the disc; a patch of the similar but more abundant (rather dense) hairs extending on each lateral stripe from the humeri almost to the postalar calli; a narrow brownish stripe between the notum and pleurae extending from just below the humeri to the wing-bases and bearing fairly abundant long orange yellow pubescence with a few conspicuons long black hairs. Scutellum large, blackish but obscured by a grey tomentum excepting of the basal half brownish dusted; pubescence much more numerous than in the thorax, rather longer and yellowish. Pleurae blackish, much more obscured by a greyish tomentum than the notum; prothorax, the upper part of the meso-pleurae, the meta-pleurae, and the posterior upper part of the sterno-pleurae densely covered with a yellowish tomentum, and three formers bearing a dense very conspicuous yellow patch of long shaggy hairs; pubescence on the rest very scattered, yellowish.

Wings as in the female, but the basal hyaline band is gradually narrowed because the basal blackish marking expands to more than the basal half of the upper basal cell and to more than the basal thirds of the second basal cell; centre of the discal cell sometimes paler.

Legs as in the female but generally darker and much more hairy; fore coxae covered with denser longer yellowish grey hairs, and bearing a very few short blackish pubescence about the apex; fore femora furnished with fairly abundant black pubescence which becomes very long at the outer and upper surface, and which is very short and is almost inconspicuous at the inner surface, there is no yellowish one; middle femora covered with numerous long black pubescence which becomes very short at the upper margin, and about the base of the outer surface there are numerous long yellowish hairs with a very few blackish pubescence intermixed; hind femora furnished wi th numerous very long yellowish pubescence intermixed with fairly

abundant similarly long black hairs, these black and yellowish hairs all becoming shoter towards the upper surface; fore tibiae with very short, inconspicuous in some part, black pubescence; middle tibiae covered with similar pubescence and bearing two unequal blackish spurs; on the hind tibiae the pubescence is black and become longer at the upper and lower margins, the two spurs blackish and about as long as in the middle tibiae; pulvilli gryish yellow.

Abdomen usually a little longer than the head and thorax (including the scutellum) together, broadest at the base of the second segment and gradually narrowed posteriorly, the apex being pointed, orange yellow excepting of the apical three segments black. Dorsum more convex than in the female; first segment blackish, with the small orange yellow lateral markings which are very rarely wanted; the following three segments with two oblique black spots in the middle of each disc, these spots at the base generally united from each other, leaving the triangular middle orange yellow spot which is connected with the narrow greyish yellow posterior border, but sometimes all or some of them separated throughout their length by a narrow orange yellow stripe which is about same in width; the anal black segments with an inconspicuous (in sometimes very conspicuous) greyish yellow line in the middle of the disc, on the first one of these segments the inconspicuous reddish spots very rarely occur before the lateral margins; pubescence short, orange yellow, becoming longer at the sides of the basal two segments and on the middle orange yellow triangle spots in the second and third segments; the orange pubescence mostly rather inconspicuous but that on the apical three segments distinct especially on the posterior margin of each segment; on almost whole the surface there is an other conspicuous pubescence which is longer and black, and becomes much longer at the black median spots. Ventre convex; first two segments with the small mibdle black spot in which the posterior one is much smaller and paler, and which is a stripe-like marking; pubescence yellowish, short, with a little darker long hairs;

genitalia brownish black with two yellowish apical lamellae which have round apical margin and bear a few pale hairs.

Length: 9–10.3 mm.

This species is easily distinguished from the other species of Japan by its peculiar somewhat zig-zag-shaped cross-band of the wings. It probably occurs throughout Formosa, although I have taken it from a few localities, Taihoku, Tamsui, Kagi, Tainan and Kosempo. In my observations during a few years, *Chrysops sinensis* is common in Formosa but the occurence is not so abundant as in *C. dispar*. It is recorded from May 15th to November 10th in Formosa, while it is known that it occurs in China. The female generally attacks cattle in the afternoon but especially near the sunset, and it often bites the back of a human body when any part is bare. On the 10th of November in 1917, my wife had her arm pierced by the female in a room already lighted up about nine o'clock in the evening, and its effect continued for wholly two days, remaining a small swollen point, but she felt not much irritation.

4. **Chrysops suavis**, Loew. (Pl. I, figs. 7 & 8.)

(Mekura-Abu)

Wien. Ent. Monatschr., II, p. 103, 1858; Verh. Zool.-Bot. Ges. Wien, VIII, p. 620, 1858.

Ricardo, Ann. Mag. Nat. Hist. (7), IX, pp. 427 & 430, 1902.

Kertesz, Cat., Dipt., III, p. 198, 1908.

Chrysops dispar, Matsumura, Thous. Ins. Japan, II, p. 81, pl. XXIV, fig. 3, 1905.

Rather large species with the black femora, with the black abdomen, with the conspicuous orange markings at the sides of the two basal segments, and with the apical abdomenal segments black leaving a narrow orange yellow median stripe.

Female. Head rather small, about as broad as the thorax. Frons quadrate with the straight sides, very slightly broadened towards

the antennae, narrower than the width of the head, densely covered with a yellow tomentum except on both the frontal callus and ocellar portion, the yellow part usually separated by a fine very short longitudinal black and shining line which extends from the frontal callus to the ocellar triangle, and the lateral yellow parts consequently triangular in shape; pubescence very few, yellowish, not long; frontal callus large almost occupied the lower half of the frons, but hardly touching to the eye-margins, convex, black and shining, its upper margin convex and its lower margin slightly angulated at the middle, with a narrow double arched yellow line between the antennae and frontal callus; vertex black and shining, but covered with a yellow dust behind the ocellar triangle which is somewhat convex and brownish, and bears a few short somewhat darker hairs; occiput greyish brown because it is slightly covered with a greyish yellow tomentum, a few long yellowish hairs just behind the vertex. Face orange yellow, moderately convex and slightly produced below, longer than half the width of the face; yellow intermediate stripe short, pointed below, and suddenly broadened transversely just before the antennae, not reaching below beyond the lateral deep pits; yellow lateral patch as in the male of *Chrysops dispar*, Fab., but usually orange yellow; facial calli black and shining, rather larger and circular, united with a very short undivided oral callus which is similar colour and is broader than its length but somewhat roundish; buccal calli large, black and shining, extending from the eye-margin to near the base of palpi, transverse and somewhat quadrate; jowls behind the buccal calli black and shining, but at the outersides narrowly covered with a yellowish dust, the yellowish line becoming very narrow and extending up to the occiput along the eye-margin, the rest part usually inconspicuously obscured by a yellowish tomentum which extends through the back of the head, bearing rather numerous moderately long yellowish soft hairs which become very short and extend up to the back of the head at where these are only appeared just behind the narrow yellow line along the

eye-margin; pubescence on the face very fine, yellowish, very few, and almost inconspicuous but on the lateral yellow patches somewhat distinct, and on the calli almost entirely bare. Proboscis stout, about as long as the depth of the head, brownish black, very slightly dusted with greyish, bearing a few short rather bristle-like blackish pubescence and with rather broad similarly colored sucker-flaps which are furnished with a very few rather short (but longer than that on the proboscis) blackish pubescence beneath; palpi lying against the proboscis, brownish black, somewhat shining and moderately obscured by a yellowish dust at the outerside, stout, broadest near the base and then gradually narrowed towards the apex which is blunt, very slightly curved forewards just before the middle, slightly longer than half the length of the proboscis; pubescence on the palpi very fine, almost inconspicuous but at the outerside rather long, pale yellowish beneath. Antennae slender, conspicuously longer than twice as long as the head, blackish brown with the yellowish first joint; basal joint a little longer than the second, very slightly dilated, usually yellow or brownish yellow and very rarely distinctly brown at the apical one-third and sometimes darker towards the tip, sparsely furnished with short black hairs; second joint thinner than the first, yellowish brown to blackish brown, with some inconspicuous annulations, and bearing a few (but much numerous than on the first joint) black pubescence; third joint rather slender, slightly upturned at the tip, longer than the two basal joints together, mostly darker, quite bare, bearing five distinct annulations of which the first is stouter than the first antennal joint and is rather dully coloured, and its basal one thirds is usually conspicuously paler; the apical annulation of the third antennal joint as long as the two preceding ones together, its apex usually very slightly incised and without any fine hairs. Eyes with the facets all equal; in death deep black somewhat coppery, occipital and hind margin with an inconspicuous deep purplish brown border which is about equal in width but slightly notched about the middle; the rest of the eye with four similary coloured isolated spots, of

which the top spot is largest and is extending from the about the middle of the frontal margin to just above the centre of the eye; the lowest one next in size, transversely oblique, subquadrate, placed near the outside of the middle of the lateral yellew patches on the face; the middle one near the eye-margin, smallest and circular, placed near the anterior angle of the eye; the last spot somewhat triangular, placed just behind the centre of the eye. Thorax rather large, moderately shining, black covered with a very inconspicuous yellowish dust, with two distinct narrow yellowish stripes which are faded towards the posterior border the space between these stripes slightly tinged with a pale yellowish dust but at the middle quite bare from this dust from the anterior margin to the posterior; the lateral margins of the meso-notum with a distinct yellow stripe which is about equal in width to the middle stripes and is fused with those at the anterior part; the side of the thorax with a conspicuous narrow blackish brown stripe from the anterior extremity between the humeri and prothorax to the base of the wings; humeri moderate in size, covered with a yellowish tomentum, not strongly convex; praealar calli triangular, rather flat but moderately large, mostly covered with the lateral yellow stripes but at the lower margins occupied by the blackish stripes on the sides of the thorax; pubescence mostly brownish, erect and fine, intermixed with suberect short golden yellow hairs which are almost always denuded when caught by net; pubescence on the sides deep golden yellow, conspicuously dense and rather long. Pleurae black and with a very inconspicuous greyish tomentum, somewhat shining, but prothorax, the upper half of the meso-pleurae, and the meta-pleurae entirely covered with a yellowish tomentum and also with numerous long golden yellow hairs, and the middle part of the ptero-pleurae and the upper border of the sterno-pleurae slightly dusted with yellowish grey; pubescence on the pleurae mostly scarce and yellowish but rather long. Scutellum rather large, somewhat semicircular, black but very inconspicuously obscured by a yellowish dust, moderately shining, bearing rather nu-

merous yellowish brown pubescence which is longer than that on the disc of the thorax.

Wings rather large, about equal as long as the body, quite clear, with the well-defined blackish anterior border which is broadened at the base of the wing, but expanding only to the extreme base of the basal cell, and is extending to just before the wing-apex; cross-band broadest in all of our species of the genus, its outer margin usually convex about the cubital vein and concave at the third veinlet from the discal cell, its inner margin from the tip of the praefurca to the lower end of the lower cross-vein usually straight, and running along the basal portion of the upper branch of the postical fork and then angularly bent downwards at the base of the lower branch of the postical fork, reaching the apex of the anal cell; postical cell at the middle somewhat distinctly clear, this clear portion extending from the posterior margin (at where it is broad and almost quite clear) to the base at where it is hardly conspicuous and very narrow; anal cell usually closed just before the margin, but sometimes distinctly open; fourth posterior cell usually contracted at the margin; discal cell always no hyaline patch, but in only one specimen from Tokio very inconspicuous pale spot in the middle; the upper branch of the cubital fork without any recurrent veinlet. Squamae usually smoky brown, with the blackish margins, and bearing a black fringe on the alar pair but on the thoracal pair with a very inconspicuous yellowish fringe; halteres brownish black, rather small with the very thin stalk.

Legs blackish brown to black, excepting of the bases of the middle and hind tarsi and of the middle tibiae pale brown to reddish brown; fore coxae longer than half the length of the femora, covered with long pale yellow hairs; fore femora including the trochanter a little longer than the tibiae, bearing blackish pubescence which becomes longer towards the outer and upper surfaces; fore tibiae very slightly dilated about the middle, rather densely covered with very short depressed blackish hairs; middle femora including the trochanter about as

long as the tibiae, bearing blackish pubescence which becomes longer at the apical portion below, on the mostly part of the lower surface long, scarce and yellowish, and on the basal outer surface very sparse, short and yellowish ; middle tibiae at the extreme apex usually darker, bearing short blackish pubescence and with two subequal blackish apical spurs ; hind femora much shorter than the tibiae, bearing a black short pubescence with rather long yellowish hairs intermixed on the basal two-third and sometimes the yellowish pubescence extending through the lower surface, but this yellowish one usually inconspicuous on the denuded specimens ; hind tibiae slightly dilated, rather densely covered with short blackish hairs which are almost suberect and are sometimes rather long and paler, two apical spurs almost equal in length, blackish and not smaller than these on the middle tibiae ; pulvilli rather long, yellowish.

Abdomen a little longer than the head and thorax (including the scutellnm) together, much broader than the thorax at the two basal segments, gradually narrowed from the third segment to the apex and never pointed but the posterior end almost always broad and very slightly curved posteriorly. Dorsum very slightly shining but rather dull coloured ; first segment black, somewhat brownish, with the yellow lateral patches which are obliquely extending to just below the side of the scutellum ; second segment largest, yellow at the middle, with two short black stripes which are extending from just above the middle of the disc to the posterior margin, and curved outwards and sometimes pointed forewards ; the following five segments black, with a narrow yellow median stripe which is extending to the sixth segment but usually faded on the last two segments ; third segment very often (but sometimes wanting), bearing a small reddish yellow spot near the anterior margin between the median yellow stripe and lateral margins of the disc, the spot usually opening at its anterior margin ; pubescence on the dorsum short and rather depressed, golden yellow on the yellow portion and blackish on the black portion but on the apical four seg-

ments with short golden yellow hairs intermixed, and on the yellowish spots on the third segment no trace of the yellow pubescence; the sides of the abdomen blackish except the first segment yellow, furnished with a rather short (but slightly longer than that on the disc) yellow pubescence. Ventre slightly shining; the basal two segments yellow, sometimes bearing a greyish irregular spot at the middle of each segment; third segment mostly yellowish, usually slightly tinged with reddish, the lateral margins and posterior border brown or blackish; the following ones black but slightly obscured by a yellow tomentum especially conspicuous at the lateral and posterior borders of each segment; pubescence rather dense and short, golden yellow.

Length: 9-11 mm.

Male. Distinctly distinguished from the famale by the blackish markings on both the wings and abdomen.

Head about as wide as the thorax. Frons somewhat long, mostly black and shining but the antennal protuberance (which is distinctly separated by a blackish groove between the antennae) covered with a greyish dust leaving around the antennal insertions quite bare; vertex black, somewhat tinged with brown, less prominent and lower than in all of our species of the genus, bearing a few rather long blackish hairs on the anterior half, and with a few long overhanging yellowish fringe behind; occiput slightly convex, black but somewhat obscured by a yellow dust, bearing a few blackish hairs on the upper part just below the vertex. Face convex more than in the female; the intermediate yellow line much narrower than in the female, extending from the upper mouth-edge to just below the antenannae, and slightly but suddenly broadened at just before transverse suture below the anntenae; facial calli much larger, somewhat pentagonal, reaching to both the eye-margin and antennal tubercle at the upper-outer angle; oral calli rather small, each somewhat elliptical, fused with the lower margin of the facial callus and expanding to just inside of the inconspicuous longitudinal furrow extended from the facial deep pit to the

upper-inter angle of the buccal callus; baccal calli very large, transverse, extending from the eye-margin to the lower mouth-edge; the lateral yellow patches obliquely transverse, somewhat subquadrate, expanding from the eye-margin to the inside of the facial deep pit at where the upper margin of the yellow patches is bent upward and is extended to the middle of the inconspicuous furrow between the facial and oral calli; the lower-inner angle of the patch narrowly stretching to the base of the palpi, the expanded narrow portion not yellow but greyish; calli all black and highly polished, and jowls entirely black, shining, and almost quite bare from dust. Pubescence on the face conspicuous and long, like the other species, mostly brownish but on the yellow patch with yellowish hairs intermixed, rather numerous but on the facial calli scarcer and on the oral calli almost absolutely bare; pubescence on the buccal calli much longer and rather denser; jowls covering numerous long rather soft yellowish pubescence which becomes shorter and extends up to the lower angle of the eye until it emerges into the blackish fringe at the eye-margin. Eyes in death deep black and with somewhat brilliant greenish reflections, quite bare, touching less than the middle third of the distance from the occiput to the antennae; facets about half dilated above, but on the lower half small, its dividing line being not sharply defined and running across somewhat semicircularly so that small facets extend a short way up the back part; the markings on the eyes deep purplish somewhat similar to those in the female but all of them larger, the onter lower triangular spot much larger and slightly touching to the longest transverse (when seen from above) one, the upper frontal one exceedingly larger and irregularly circular, the middle one somewhat circular not much larger, and the lowest one transverse and reaching the eye-margin as in the female; marking on the lower and hind margin subequal in width and conspicuously and sharply notched at almost near the outer angle of the triangular spot. Proboscis short but somewhat stout, shorter than two-thirds the depth of the head, black, and inconspicuously dusted

with yellowish but moderately shining, bearing a few short blackish pubescence which is quite similar to that in the female, and with rather large sucker-flaps; palpi about two-thirds as long as the proboscis, blackish and moderately shining, very inconspicuously covered with a greyish dust on the outerside, much longer and slender than those in the female, somewhat dilated near the base and gradually narrowed towards the apex and then somewhat pointed; pubescence on the palpi brownish black and long, especially on both the base and upper surface, very scarcer on the lower surface, lying less against the proboscis. Antennae blackish brown with the dull yellow first joint, which is longer and stouter than the second, and is slightly smoky at the apex; second joint subannulated, covered with blackish pubescence which is slightly shoter than that on the first but much numerous; third joint dark brown or black, narrower than in the female at the base.

Thorax black, somewhat obscured by a brown dust, slightly shining, with two well-defined fine yellowish stripes on the disc, and with a broad yellow stripe at the side of the disc, the former not reaching to the posterior margin and hardly extending to the posterior one thirds, the latter extending through the whole length of the side; the lateral blackish band from the prothorax to the base of the wing distinct and partly covered with long blackish hairs; pubescence on the disc nearly erect, long, and blackish brown, mingled with rather short subdepressed yellowish hairs, on the side (=lateral yellow stripe) very dense, suberect and directed above, golden yellow, but this golden pubescence rather sparser on the postalar calli, and with a few long rather stout blackish hairs on the praealar calli intermixed; scutellum black and very slightly tinged with a greyish yellow dust, moderately shining somewhat triangular with a round posterior angle, bearing a rather few long yellowish hairs; pleurae blackish, moderately obscured by a yellowish tomentum and furnished with a long rather numerous yellowish pubescence; prothorax, the upper part of the meso-pleurae, and the meta-pleurae conspicuously covered with a yellowish tomentum

and furnished with dense and long golden yellow hairs.

Wings much shorter than the length of the body; the basal blackish portion expanded towards the apical border of the basal cell and fused with the cross-band at the basal angle of the postical cell, leaving only a small quite clear spot which narrowly extends from the praefurca to the short basal portion of the upper branch of the postical fork along the inner margin of the cross-band, this clear spot broadened on the upper basal cell and its inner margin extending from just behind the base of the praefurca to the base of the upper branch of the potical fork being inwardly angulated at the discal vein; cross-band more well-defined, with the straight outer margin, and with the inner margin like that in the female; postical cell much inconspicuously lightened from the base to the margin of the wing; anal cell closed before margin and fourth posterior cell contracted at the margin but less than in the female; upper branch of the cubital fork without recurrent veinlet. Squamae and halteres like in the female.

Legs much haired and the clour similar to the female; fore coxae much longer than half the length of the femora, rather conspicuously dusted with yellowish grey, bearing much longer brown pubescence with very long yellowish hairs intermixed on the outer basal part; fore femora furnished with a rather long blackish pubescence which becomes denser towards the apex; fore tibiae slightly shorter than the femora (including the trochanter), bearing short rather depressed blackish pubescence; middle femora on the lower surface furnished with a few extremely long blackish brown hairs which become shorter but denser at the apical portion; hind femora covered with short rather stout somewhat depressed blackish hairs on the upper surface and furnished with conspicuously long same coloured hairs which become slightly shorter but not denser towards the apex; hind tibiae moderately dilated, bearing a blackish pubescence as in the female but distinctly longer, and with two thin but rather long almost equal brown apical spurs which are longer than the subequal somewhat stouter ones on the

yellowish middle tibiae.

Abdomen much broader, slightly longer than the head and thorax (including the scutellum) together. Dorsum blackish and moderately shining, with the large quadrate lateral orange yellow spots at the base and a narrow orange yellow median stripe extended from the posterior margin of the second segment to the fifth segment, as well as two conspicuous small, round, reddish yellow spots on the third segment; the lateral quadrate yellow spots occupying about one-third of the second segment leaving a narrow posterior black margin but their outer borders narrowly extending from the anterior margin of the first segment to the posterior margin of the second, bearing short rather depressed yellow pubescence which becomes longer and much erect at the side and is intermixed with a very few blackish hairs on the first segment; a small distinct spot on about the middle of the lateral half of the third segment; pubescence short, rather dense and mostly suberect, blackish brown, intermixed with a few short depressed yellowish hairs on both the hind part and yellow median stripe. Ventre like in the female, but the first segment with a conspicuous large triangular dull black spot expanded to just before the middle of the second segment which has also a small well-defined same coloured spot just below angle of the preceding spot and the third segment bearing a narrow longitudinal black spot near its lateral margin.

Length: 7–10.2 mm.

This speces is easily distinguished from the other species of this genus, by the large cross-band about uniformly coloured, and reaching to the posterior margin, and varies but little in the Japanese specimen I have seen, and as I have already described. The above description of the male has been made from only one specimen, collected at Takasago in Japan, by Prof. S. Matsumura, this being conspicuously distinguished from the female by the colouring of the abdomen, and by the wing-marking.

The rather large species, is very common in Hokkaido, and is

very often found on the back of cattle or horses, as well as in shrubs. I have records from Sapporo, Josankei, Morioka and Takasago, from July 26th to August 1st.

5. **Chrysops basalis**, Shir. (n. sp.) (Pl. II, figs. 2 & 3; Pl. IX, figs. 3 & 4.)

(Kigoshi-Mekura-Abu.)

Smallest species with the black abdomen except the second segment almost entirely yellow, and the wings with a broad cross-band which is extremely deeply incised from the posterior margin. Very closely allied to the preceding species.

Female. Head rather large, much broader than the thorax, frons broad, usually parallel-sided but sometimes very slightly divergent towards the antennae, depressed across the middle because the ocellar triangle above and the large frontal callus below are rather elevated, black or blackish castaneus brown, shining but the part between the frontal callus and vertex very minutely granulated and concave; antennal tubercle at the middle deeply incised above, brown slightly obscured by a greyish tomentum below the frontal callus, which is very large, convex and shining black or dark brownish black, the upper margin of the callus being very slightly incised and its lower margin being moderately angulated; pubescence on the frons rather long and pale yellow, and on both the callus and antennal tubercle quite bare, vertex blackish moderately convex, with an inconspicuous ocellar tubercle which is somewhat conspicuously dusted with yellowish, this colour at the lower side outwardly obliquely expanding to near the upper margin of the frontal callus but very narrowly like a fine stripe; pubescence on the vertex long and mainly pale yellow with a very few blackish hairs intermixed; occiput blackish, somewhat conspicuously obscured by a yellowish dust, and furnished with rather numerous long somewhat puffed yellowish hairs. Face similar to

Chrysops suavis; whitish yellow intermediate stripe short, much narrower than that in *suavis*, triangularly widened just below the antennae and pointed below, not reaching below beyond the lateral deep pits; yellow lateral patches obliquely transverse, narrow, not triangular as in *suavis*, extending from the eye-margin to the mouth-edge; facial calli blackish brown and shining, very large and somewhat circular, united with a somewhat triangular undivided oral callus which is longer than the width and is much darker than the facial calli; buccal calli large, blackish and polished, extending from the eye-margins to the bases of palpi, transverse and somewhat triangular; jowls behind the buccal calli black and shining, but very inconspicuously dusted through the whole surface. Pubescence on the face very fine, yellowish, and almost inconspicuous but on both the lateral patches and intermediate stripe somewhat distinct, and on the calli almost entirely bare but on the lower part of the oral callus somewhat recognisable; pubescence on the jowls rather numerous, long and yellow, much longer towards the mouth-edge, and becoming shorter towards the eye-margin and back of the head. Back of the head greyish black, slightly shining, and slightly obscured by a whitish tomentum. Proboscis not stout, a little shorter than the depth of the head, brownish black, slightly dusted with greyish yellow, bearing a few short and erect rather bristle-like brownish hairs on the lower apical portion; sucker-flaps somewhat shining, furnished with a very few erect and short, but longer than that on the stalk, blackish pubescence beneath; palpi lying against the proboscis, brown, darkened towards the tip, slightly shining, but very inconspicuously dusted with greyish yellow specially on the lower surface, very slightly curved forwards, narrow and gradually narrowed towards the apex which is not pointed, longer than half the length of the proboscis; pubescence on the palpi yellowish, fine but conspicuous, excepting of that on the inner surface. Antennae slender, about as long as the thorax (not including the scutellum), yellowish brown; basal joint yellowish to pale yellow-

ish brown, cylindrical, slightly longer and very slightly broader than the second joint, furnished with a few short blackish pubescence; second joint very slightly thicker towards the apex, yellowish brown to brown, somewhat blackish, with three somewhat distinct annulations, and bearing somewhat numerous stout and short (but longer than those on the first joint) blackish hairs; third joint about as long as the two basal joints together, distinctly upturned at the tip, mostly greyish black, quite bare from pubescence, bearing five distinct annulations of which the first is stouter than the first antennal joint and is about as long as the following joints together, as well as it is rather paler and yellowish at the basal one-third, this annulation having 5 indistinct contracted portions when seen from above; apical annulation of the third antennal joint longer than the preceding one but shorter than the two preceding ones together, with a blunt apex at where a few very inconspicuous hairs are seen under the microscope. Eyes with the facets all equal; in death deep greenish black, occipital and hind margin with an inconspicuous deep purplish black border which is broadened below and not notched about the middle; rest of the eye with four inconspicuous deep purplish black isolated spots, of which the top one is largest and transverse (but slightly oblique) when seen from above, and is extending from about the middle of the frontal margin (hardly touching the margin) to far above the centre of the eye; the lowest spot obliquely transverse and subquadrate, and placed above the lower angle of the eye and slightly touching to the eye-margin; the middle spot smallest, somewhat triangular but with angle rounded, placed near the inner angle of the eye but entirely apart from the eye-margin and in equidistance from both the upper and lower spots; the fourth spot (=central spot) next in size, rather long almost parallel to the occipital band, the both ends sharply pointed, at the middle triangularly noched forwards, and entirely isolated from the others.

Thorax rather small, a little longer than the width, moderately shining, black covering with a very inconspicuous greyish white dust,

on the disc with two indistinct whitish stripes which are hardly reaching to the hind one-thirds, the space between these stripes very inconspicuously, but somewhat much distinct more than that on the rest of the disc, dusted ; the lateral margins of the thorax with a distinct whitish yellow stripe which is about three times as wide as the median stripes, and is hardly united with those at the anterior part, as well as it is extending to the postalar calli ; the side of the thorax with a conspicuous narrow blackish brown stripe just below the yellowish lateral stripes and extending from the posterior extreme between the humeri and prothorax to the base of the wing ; humeri moderate in size, but distinctly smaller than that in the preceding species, covered with a greyish yellow dust, somewhat convex about as large as the prothorax ; praealar calli large and triangular, not convex, almost entirely covered with the lateral stripes, but the extreme lower margin occupied by the lateral stripe ; pubescence mostly pale yellowish, suberect, rather numerous, and almost entirely not intermixed with any others ; pubescence on the side pale golden yellow, conspicuously dense and rather long, by which the lateral yellowish stripes are almost entirely covered. Pleurae brownish black, but slightly obscured by a greyish dust, somewhat shining ; prothorax, the upper half of the meso-pleurae, and the meta-pleurae covered with a greyish yellow tomentum and also with pale golden yellow hairs which on both the prothorax and meta-pleurae are rather less ; ptero-pleurae and the upper border of the sterno-pleurae slightly dusted with greyish ; pubescence on the pleurae, except on the parts mentioned above, scarce, fine but rather long, yellowish. Scutellum rather small, somewhat triangular with a rounded posterior angle, deep brownish black obscured very slightly by a greyish yellow tomentum, moderately shining and bearing a rather numerous suberect pale yellowish pubescence which is longer than that on the disc of the thorax.

Wings moderate in size, distinctly shorter than the length of the body, clear, with the well-defined blackish anterior border which

is irregularly widened below at the base of the wing, and is extending to the wing-apex; cross-band well-defined, blackish without any cleared spot on the proper band, with almost straight outer margin (in some specimens very slightly outwardly angulated in the submarginal cell), from about two-third the length of the radial vein to near the end of the third veinlet from the discal cell; the inner margin of the cross-band from the tip of praefurca to the extreme of the second basal cell straight, running along the upper branch of the postical fork and reaching to near its apex; an accessory blackish marking on the lower branch of the postical fork hardly touching to the proper cross-band at the base of the postical cell, and extending from the base of the lower branch of the postical fork to the apical end of the anal cell; anal cell usually very narrowly open, but sometimes closed at the wing-margin; fourth posterior cell slightly contracted at the margin; the upper branch of the cubital fork without any recurrent veinlet; veins brownish excepting of the postical and anal veins pale yellowish. Squamae usually smoky brown, with the blackish margins, the alar pair bearing a black fringe but the thoracal pair furnished with a very inconspicuous yellowish one; halteres blackish but slightly obscured by a greyish dust; with the very thin stalk.

Legs brown to brownish black, excepting of the basal joint of the middle and hind tarsi usually yellowish brown; fore coxae longer than half the length of the femora, moderately covered with very short brownish or blackish hairs and on the basal half with a few rather long pale yellow hairs; fore femora (including the trochanter) a little longer than the tibiae, not dilated, furnished with rather numerous moderately long brownish or blackish hairs which become shorter and sparser towards the lower margin; fore tibiae very slightly paler than the femora, densely covered with very short depressed hairs which are always darker than the colour of tibiae; middle femora (with the trochanter) as long as the tibiae, covered with many short depressed brownish or blackish hairs which are intermixed with somewhat long

yellowish hairs especially at the basal half; middle tibiae usually paler, and at the basal part almost always yellowish, entirely covered with somewhat numerous short depressed (but not on the lower margin) brownish hairs, the end bearing two short subequal brownish spurs; hind femora (including the trochanter) shorter than the tibiae, covered with rather few short depressed brownish or blackish hairs, but on the lower margin bearing a few somewhat long suberect hairs which on the basal half are usually pale yellow and which on the apical half is almost always brownish; hind tibiae very slightly dilated, a little paler than the femora, covered with numerous short, but longer than those on the middle tibiae, suberect, brownish hairs, and bearing two very short brownish or blackish apical spurs; hind tarsi longer than two-thirds of the length of the tibiae, covered with numerous short brownish hairs, the apical joint bearing a very few long brownish curved hairs on the upper apical margin and bearing rather long yellowish pulvilli.

Abdomen apparently longer than the head and thorax (including the scutellum) together, and much broader than the thorax, but gradually narrowed behind, the anal end never pointed but very slightly curved outwards. Dorsum moderately convex but on the apical border rather flat, slightly shining; first segment brownish black, with the very narrow yellowish white side; second segment mostly yellowish white, but at the posterior margin with a narrow brownish black band which is entirely triangularly interrupted at the middle where it is broadened itself, the band slightly concave at each side of the anterior margin, from the middle; third segment entirely brownish black, with an inconspicuous pale yellow middle spot which is slightly longitudinal and is sometimes entirely wanted; the following segments unicolorus brownish black but slightly darker than the preceding segment, very rarely a very inconspicuous small pale yellownish spot existing on the fourth segment; pubescence on the dorsum of the abdomen moderately numerous, brownish and depressed, excepting on the yel-

lownish parts almost entirely yellowish and suberect, but on the last 4 segments and posterior margin of the third segment with somewhat numerous, suberect, and pale yellowish hairs intermixed. Ventre lighter than the dorsum, slightly coverd with a greyish yellow dust, moderately convex but slightly concave posteriorly, the basal two segments and anterior margin of the third segment pale yellowish white, the remaining segments pale brownish black, gradually darkened towards the anal end, very often at the side of the second segment with an inconspicuous pale brown longitudinal stripe, and in the specimens from Hokkaido a small brownish stripe at the middle of the second segment; pubescence rather dense, very fine and depressed, pale yellowish white but on the blackish part with a very numerous very short brown pubescence.

Length: 9-9.8 mm.

Male. Smaller than the female and distinguished from the female by the yellow marking on the abdomen as well as by the blackish base of the wings.

Head rather small, but slightly broader than the thorax. Frons rather long and narrow, with the moderately broad antennal tubercle which has a fine groove between the antennal bases but it is not reaching towards the face, so that the tubercle is not entirely separated by the groove, brownish somewhat shining but on the antennal tubercle with greyish dust, quite bare from pubescence, on the middle with a small but conspicuous longitudinal carina; vertex entirely occupied by the ocelligerous tubercle, which is much prominent and is blackish but very slightly obscured by a greyish yellow tomentum, and which is bearing a few long brownish black hairs on the anterior half and has also a very few much longer overhanging brownish fringe behind; occiput very slightly convex but slightly sunk from the back of the head, blackish but distinctly dusted with greyish yellow, on the upper border just below the vertex bearing a few moderately long yellowish fringe which is somewhat overhanging the posterior margin of the ocelligerous tubercle. Face convex very slightly more than in the female, the upper part

much contracted more than in the female which has the straight side of the face but in the male the side outwardly curved just below the antennal tubercle; the intermediate yellow line much broader, conspicuous and reaching to the upper mouth-egde, gradually broadened above at where a fine and paler transverse line is along the transverse sulcus below the antennal tubercle; two shining black facial calli nearly pentagonal and indistinctly split by an inconspicuous longitudial furrow into a large inner and smaller outer part, united with the two small shining black upright rather broad oral calli which are placed just above each side of upper mouth-edge; the narrow yellowish lateral patches which extend from the eye-margins to the lower mouth-edge at where the patches are very inconspicuous and consequently separate the facial and buccal calli, as well as indistinctly the oral and buccal calli at near the mouth-edge; jowls behind the buccal calli inconspicuously greyish brown, with pubescence all yellowish on their lower part and behind the mouth but brownish on their upper part and near eyes; back of the head flush with the eyes, blackish but obscured by a greyish yellow tomentum; and bearing a very minute black bristly postocular fringe; pubescence on the face consisting of moderately numerons long brownish hairs which are absent from the oral calli and facial calli excepting of the upper outer part and from a small space between and just above the oral calli, and some yellow hairs occur outside the oral calli. Proboscis brownish black, somewhat obscure greyish yellow, shorter than the depth of the head, rather thin, bearing very minute somewhat bristly suberect brownish hairs, and with the slightly broad sucker-flaps which are furnished with longer brownish hairs beneath. Palpi deep brownish black, rather shining, about twice as long as the proboscis, very slightly dilated near the base but long and cylindrical, elevated at right angles to the proboscis, and bearing moderately numerous, rather long, blackish pubescence but with some yellowish hairs beneath about the base. Antennae in some lights rather shining, much shorter than the head and thorax (including the scutellum) together,

but longer than the former; basal joint not much larger or stouter than the second, pale yellowish but very slightly tinged with brownish at the apex of the lower surface, and bearing conspicuous long blackish erect hairs all over but stout the middle of the upper margin with a very few but distinctly longer pale yellow (in some lights rather shining) hairs; second joint with similar but shorter mostly suberect and much numerous hairs (of course without yellowish ones), shorter than the first, dull brownish, and with two apparent constrictions; third joint deep black but dull, about as long as the two basal joints together, somewhat subulate but slightly thinner about its base, and rather upturned at its tip, the first annutation much longer than the four remainings and pale brown at the basal half, the apical annulation much shorter than two preceding ones together and with the blunt apex but there is a very minute process. Eyes bare; facets on nearly the lower half smaller than those on the upper part, but with no sharply contrasted division the semicircular boundary line, and on the back part the small facets extend upwards a little but not nearly to the vertex; eyes in death brownish black but on the part occupied by the large facets pale greenish yellow, excepting of the posterior margin brownish; two transverse reddish brown bands on the yellownish part when viewed from above, of which the hind one is much longer and is connected with a small somewhat triangular similar colored spot about the upper boundary of the brownish part, and the fore one of which is about half as long as the hind but broader, both the bands parallel to the back margin of the eye and far apart from the frontal margin; ocelli pale ruby in colour.

Thorax black, the middle part slightly obscured by a rosy brown tomentum, moderately shining, with two narrow greyish stripes on the disc, the stripes being a little broader than those on the preceding species and somewhat indistinct but reaching to the posterior margin of the mesonotum, the lateral stripes on the disc orange yellow, extending through the whole length, being gradually narrower posteriorly;

the lateral brownish black stripes from the prothorax to the base of the wing distinct and mostly uncovered with hairs; pubescence on the disc mostly erect, very long and yellowish brown, on the lateral yellow stripes very dense but rather scarcer on the postalar calli, suberect and directed upwards, entirely golden yellow; scutellum shining, black and slightly obscured by a rosy brownish dust, somewhat triangular with roundish posterior angle, bearing a few long suberect yellowish brown hairs which mostly appear around the margin; pleurae black, shining but slightly obscured by a yellowish tomentum, furnished with a few long, pale yellow hairs; prothorax, the upper part of the meso-pleurae, conspicuously covered by a yellowish dust and furnished with numerous long soft golden yellow hairs.

Wings moderate in size, nearly as long as the thorax and abdomen together, clear but very slightly fumated; markings almost as in the female, but upper basal cell nearly entirely blackish brown, near the apex with a quite clear band, and second basal cell at the inner half clouded; anal cell closed at the margin.

Legs much darker than those in the female, but the basal joint of the middle and hind tarsi much lighter; fore coxae moderately covered with long yellowish white hairs which gradually become shorter and sparser apically, a few rather stout but short hairs on the inner apical portion; pubescence on the fore femora brownish black, rather dense and long, becoming shorter towards the inner and apical parts; fore tibiae rather distinctly paler at the basal part, densely covered with a depressed short brownish black pubescence; middle coxae furnished with a very few rather stout long blackish hairs; middle femora covered with suberect long brownish black hairs which become shorter towards the upper margin; pubescence on the hind femora long, nearly erect, not very much dense, brownish, intermixed with a very few long yellowish hairs, on the upper margin suberect and much shorter and with a few short erect yellowish ones intermixed; hind tibiae densely covered with suberect somewhat long brownish pubescence;

apical spurs of the middle and hind tibiae moderate; pulvilli yellowish brown; curved hairs on the apical margin of the apical tarsal joint distinct. Abdomen longer than the head and thorax (including the scutellum) together and broader than the thorax, slightly narrowed behind, the anal end somewhat pointed. Dorsum convex throughout the whole surface, slightly shining; first segment as in the female; second segment mostly yellowish, excepting of the posterior about half brownish black, the blackish portion narrowed towards the side and not reaching to the lateral margin; the remaining segments brownish black with a narrow pale reddish yellow stripe and six small same cloured spots, the former situated at the middle and extending from the middle of the blackish part of the second segment to the posterior margin of the fourth segment, four in the latters on the third segment and the others on the fourth segment, two of the spots on the third segment, long triangular near the lateral margin and extending from the anterior margin to below the middle, the other spots irregularly round in which two on the third segment are larger than those on the following segments; genitalia furnished with fine whitish hairs, brown about the base but with two terminal lamellae which are yellowish at their ends. Pubescence suberect, brownish black; but orange yellow at the side of the two basal segments and on all the orange parts; the yellowish hairs at the sides longer than others; pubescence at the posterior margins of the three apical segments whitish yellow (with a blackish one intermixed), rather depressed. Ventre pale orange yellow excepting of the three apical segments and of the posterior margin of the third segment brownish black; the first segment with an inconspicuous brownish spot at the middle; the orange part with an inconspicuous pale reddish yellow stripe at the middle; pubescence blackish but whitish yellow on the two basal segments, and the pubescence on the third segment scarcely intermixed with a yellowish one.

Length: 8.5 mm.

Described the above from four females and only one, but

well-preserved male.

This species has been mixed up with *C. suavis* for a long time, but after prolonged study I am unable to identify it with the latter species. It is easily distinguished from *suavis*, in the female by its second antennal joint not being narrower than the basal joint, by the outer margin of the cross-band of the wings not being curved outwards, and by the second dorsal segment of the abdomen with the black posterior margin which is incised in the middle; in the male by the second dorsal abdominal segment being orange yellow at about the basal two-thirds not interrupted by the black median stripe, by the third and fourth dorsal segments of the abdomen having a yellowish middle stripe and two similar coloured spots, and by the cross-band of the more hyaline wings being clearly incised in the postical cell.

Chrysops basalis varies but very little in the females, the third dorsal abdominal segment sometimes having a very inconspicuous small yellowish stripe in the middle. It may be not very common, as I have only records from Akaiwa (near Otaru, Hokkaido), Niigata, Onuma (near Hakodate), Ajigasawa and Owani. My captures range from August 17th to 24th. It is well known that the female bites horses or cattle. A male was taken in shrubs near a mountain-stream at Owani.

6. Chrysops sakhalinensis, Pleske.

Ann. Mus. Zool. Acad. Imp. Sc. St.-Petersbourg, XV, p. 472, pl. IV. fig. 9, 1910.

Blackish species with the cross-band of the wings entire and reaching the posterior margin, with the apical spot beyond the upper branch of the cubital fork, and with the black abdomen which has the large yellow lateral spots on the first two segments and has a narrow yellowish median stripe on the second to fifth segments.

Female. Vertex and frons yellowish grey, face dusted with yellow. Frontal callus large, dark brown. Facial calli shining black, their prolongations very wide as they are almost connected together

leaving only a narrow yellow tomentose median line. Buccal calli large, separated from the eye-margins and not reaching the mouth-edge. Pubescence on the head yellow, that on the jowls longer. Palpi dark brown, yellow pubescent. First and second antennal joints the same in length; third joint about as long as the basal two joints together. The first antennal joint dark yellow, blackish towards the end; the second yellow, towards the upper side and the end becoming blackish; the third at the base yellow and then black apically. The first and second antennal joints covered with black hairs. The ground colour of the thorax and scutellum dark brown, on the former there are two narrow yellowish stripes which are extending about the anterior two-thirds of the disc. The sides of the thorax with broad yellowish grey stripes at the anterior parts of the wing-bases from which to the humeri the brown ground colour is seen. All the pleurae greenish grey. Pubescence on the thorax and scutellum yellow, on the disc scarcer and shorter, at the sides long and dense. The first abdominal segment at the sides yellow, in the middle black; the black spot on this segment at the antero-lateral angles rounded, the outer margin below the angles incised and then gradually extending obliquely outwards to the posterior margin of the segment. The second abdominal segment deep yellow, but at whole the hind margin black, and in the middle there is a broad black stripe which becomes broader towards the posterior end and extends to the third segment, and which has a distinct long yellow median line continuing to that on the third segment. The following segments black, on the fourth and fifth segments there is a narrow median stripe which is rather greyish. The hind margins of the sixth and seventh segments dark yellow. Pubescence on the abdomen yellow at the sides of the second segment, and yellowish grey on the four apical segments. The first, second and third segments of the underside yellow, the former with a small blackish grey spot in the middle; the fourth segment in mostly part yellow, but the hind margin broadly black; the following segments black. Pubescence on the belly depressed, yellow. Legs

black, with the basal four-fifth of the middle tibiae and the bases of the tarsal joints of the middle and hind legs yellow. The sparse pubescence on the femora dark brown on the fore legs, and yellow on the middle and hind legs. The wing-markings brown; the apical spot very narrow and long, somewhat extending over the upper branch of the cubital fork. The upper basal cell of the wing brownish about the basal thirds, and the second basal cell with a small spot at the extreme base. Described from three females taken in the Sakhalin Island, preserved in the Museum of the Imperial Academy of Science in Peterograd.

This species is not known to me.

7. **Chrysops nigricornis,** Matsumura. (Pl. II, fig. 1; Pl. IX. figs. 5 & 6),
(Karafuto-Mekura-Abu).

Journ. Coll. Agr. Tohoku Imp. Univ. Sapporo, Japan, IV, 1, p. 66, 1911; Thous. Ins. Japan, Addit., II, p. 385, pl. XXII, fig. 14.

A small dark coloured species with a rather hairy body, with the black antennae, with the extreme hind margins of the black abdominal segments yellowish, and with the rather small hyaline parts of the wings.

Female. Head rather small, nearly as wide as the thorax. Frons broad, slightly divergent towards the antennae, at its narrowest part occupying more than one-third of the head, blackish but entirely covered with a whitish or yellowish grey tomentum, moderately depressed across the middle between the large frontal callus and the ocellar triangle; the large callus quite bare and with a slightly arched upper margin, but the depressed part with a whitish or yellowish pubescence, and the upper part of the frons with numerous tawny pubescence; just above the antennae a double lunulate narrow band of a white or yellowish white dust extending completely round the antennae and for its full width to eyes, and connected beneath the antennae with the similarly yellowish white middle line down the face; frontal callus conspicuously elevted, somewhat transverse quadrate, nearly occupying through the

width of the frons, leaving very fine eye-margin; ocellar triangle moderately convex, rather large, quite bare of dust, but covered with a numerous yellowish pubescence. Face broad, the broadest part about half as the length, mainly covered with a whitish yellow tomentum; facial calli very large, nearly roundish, deep black, hardly touching to the eyes; eye-margins narrowly whitish yellow and connected with the moderately broad whitish yellow band which separates the facial calli from the buccal; buccal calli rather large and shining black, nearly touched to the eyes, but separated from the oral calli by an obscure grey-dusted space; oral calli somewhat round, shining black, shortly separated at the middle by the yellowish white intermediate line of the face. Occiput covered with numerous long yellowish hairs, which gradually become shorter towards the back of the head. Pubescence on the face composed of somewhat abundant pale hairs on the yellowish parts, somewhat stout, scattered, and blackish pubescence on the facial and oral calli; pubescence on the jowls rather dense, long, yellowish, which extends on the back of the head (near but not on the eye-margin). Proboscis moderately stout, nearly as long as the depth of the head, dull black, slightly shining, bearing a few very fine brownish pubescence on the lower surface; sucker-flaps somewhat shining, furnished with a short erect and sparse pubescence beneath; palpi lying against the proboscis, brown, paler towards the base, obscured by a greyish dust especially on the upper and outer surface, very slightly curved forwards, narrow but dilated at the middle part, gradually narrowed apically, with the obtuse apex, slightly shorter than two-thirds the length of the proboscis; pubescence on the palpi yellowish brown, fine but conspicuous, nearly depressed. Antennae rather short, shorter than the thorax, (not including the scutellum), black; basal joint slightly longer than the second, cylindrical, furnished with a few long somewhat stout black pubescence, especially on the lower surface longer; second joint slightly narrower than the first joint, black, composed of three inconspicuous annulations of which the middle one

is smallest and the basal one is longest, furnished with a black pubescence which is similar to that on the first joint; third joint slightly nearly as long as the two basal joints together, subulate, bare from pubescence, moderately upturned at the tip, composed of five fairly distinct annulations of which the first one has four or five inconspicuous annulations, and is obscured by a greyish dust, the apical annulation seen from side with an obliquely truncated apex. Eyes with the facets all equal, in death deep blackish green; occipital and hind margin with a dark purplish brown border which has a deep indentation (about three-quarters its width) in the middle, and this border is broadest just above the indentation and again at its lower part; rest of the eye with four purplish brown isolated spots, of which the three near the frontal and facial margin are about equidistant (at the outer margin) from each other; the top spot is transverse (when see from above) and conspicuously narrowed, and is the largest of the three; the middle spot is the smallest and is irregularly round; the lowest spot is near the bottom part of the occipital band and is irregularly round; the isolated fourth spot near the middle of the eye is triangular with an angle rather near though rather below the outer-most part of the projection of the occipital band; all of the spots is without any sign or a shaft running from it.

Thorax rather small, black obscured by a greyish tomentum, moderately shining, with two rather broad ashy grey or yellowish grey stripes on the middle of the two-third front part, which are separated by a narrow dark line, an ashy grey or yellowish grey stripe at the lateral margins of the disc narrow and extending from the humeri to near the posterior margin pubescence all tawny and sloping, not at all dense on the disc and in fact rather scarce on the front though fairly conspicuous in good specimens, denser, longer and golden yellow on the lateral stripes. Scutellum rather large, somewhat triangular, a little broader than the length, black but obscured by a greyish dust, slightly shining, somewhat densely covered with fine but long sloping pale yellow hairs. Pleurae black, rather densely covered with a grey-

ish tomentum and sparsely covered with a tawny pubescence which becomes longer and darker (golden yellow) on the prothorax, mesopleurae and metapleurae; prothorax entirely covered with a dense yellowish tomentum; a narrow line between the thorax and pleurae blackish brown, without any pubescence.

Wings with less conspicuous hyaline spaces than in the females of other species from Japan, the black colour about the base and along the costa to the tip extending down to the radial vein, and a broad not entire blackish band lies across the middle with occupies more than the length of the discal cell as it is bounded on one side by the base of the cell and extends on the other side distinctly beyond that cell; the inner margin of this band is straight till it reaches the postical cell and then follows the base of the cell; the outer margin is irregular and not very marked, in the submarginal cell concave and its lower end reaching to the base of the second submarginal cell, then follows the cubital vein in the short distance, and in the first and third posterior cells it distinctly convex and in the second posterior cell somewhat convex; the third posterior cell not clouded entirely with the cross-band, but the apical half or extreme apical portion quite clear; the postical cell hyaline at the upper apical portion but along the lower branch of the postical vein dark shading; the discal cell with an inconspicuous hyaline spot in the middle; in two specimens an inconspicuous hyaline spot appears in both the submarginal and fourth posterior cells which are occupied by the cross-band; an apical band extends from the costal stripe to nearly half-way (in two specimens only one-third-way) across the cubital fork-cell with a rather vaguely defined semicircular lower margin, but does not include the actual tip or base of the cell; the hyaline space between the middle and apical band forms at its upper part a well-defined hyaline space extending from the cubital fork upwards almost across the first submraginal cell; the basal black marking extends about half-way (or about two-third) along the upper basal cell and only a short distance (or about half-way)

along the middle basal cell; the upper branch of the cubital fork without any veinlet; the postical vein very faintly clouded; the anal cell open, but in a specimen caught at Soyorofuka closed at the margin of wing. Squamae blackish brown with a obvious golden fringe in the alar pair near the angle. Halteres blackish brown with the paler tip.

Legs black, moderately shining, with the basal half of the first joint of the posterior tarsi and with the basal part of the middle tibiae obscurely reddish; front coxae about two-thirds as long as the femora, and bearing long pale yellow hairs which gradually become shorter and darker towards the apex; front femora with rather abundant pubescence which is nearly all black, the pubescence on the inner surface shorter than that on the outer surface; the middle femora with a short black pubescence but with long yellowish hairs at the basal two-thirds; hind femora with similar pubescence, which is less numerous and contains some yellowish long hairs at the lower margin of the basal two-thirds; for tibiae with a very short blackish pubescence; middle tibiae with a similar pubescence and with two not quite equal blackish spurs; hind tibiae with the dense black fringes of which the antero-dorsal one is coarser and longer, and with two short yellowish brown or blackish spurs; pulvilli yellowish brown.

Abdomen much longer than the thorax and head together, and much wider than the thorax, with rounded posterior margin, and with the apical half sloping downwards, moderately shining black with yellowish markings and with a fairly abundant pubescence. Dorsum slightly convex; first segment with somewhat triangular yellowish lateral markings which are broader hindwards, and with an inconspicuous small triangular similar coloured spot in the middle of the posterior margin; second segment with somewhat large yellowish lateral markings and a conspicuous flat-triangular paler spot, the black portion at the anterior margin as wide as the posterior margin of the black portion of the preceding segment and at the posterior margin hardly reaching to the lateral ends of the posterior margin of the segment and the lateral

margin of the black portion slightly curved inwards near the base; third segment with an inconspicuous small flat-triangular whitish yellow spot in the middle of the posterior margin; all the segments (except the first one) with a narrow pale orange yellow band on the posterior margin; pubescence orange at the sides of the two basal segments and often on all the yellowish part, but frequently the tiny hairs are blackish on the inner front part of the yellow spots on the first segment with a few stragglers on the rest, and sometimes black hairs extend though inconspicuously over all the yellow part of the disc; the black part of those segments are shorter than the hairs on the yellow part; a rather conspicuous triangle patch of whitish yellow hairs occurs on the yellowish triangle against the middle of the hind margin and also on the middle of the hind margin of the fourth (or fifth); pubescence black on the black part but at the side margins and on the discs of the fifth and sixth segments always with somewhat long orange yellow hairs intermixed; the longest pubescence on the abdomen is the black fringe at the sides of the third, fourth, and fifth segments. Ventre strongly convex, excepting of the apex somewhat concave; first and second segments orange yellow with a large not well-defined dull brownish black spot in the middle; on the third segment the sides and hind margin are rather inconspicuously orange, while on the next three segments the hind margins are rather narrowly orange; pubescence nearly all yellowish, especially as fringes on the hind margins, but the segments (after the two basal ones) bear some black hairs (in a specimen caught at Shisuka very abundant) on the disc.

Length: 8-10 mm.

I described the above from only three specimens presented by Prof. S. Matsumura. I could hardly identify it from his description, as it is too short and is not acceptable in some parts. I, however, adopt the name, as the specimens are entirely the same with the type. The male is not known to us.

This species very closely agrees with the description of *Chry-*

sops makerowi, Pleske (Ann. Mus. Zool. Acad. Imp. Sc. St.-Petersburg, XV. p. 469, pl. IV, fig. 8, 1910), but it differs from the latter in just a few points. I thought it may be a synonomy o *makerowi*, but I cannot determine this without seeing the type or species.

According to Prof. S. Matsumura the flies are common in Sakhalin Island, but its economic importance among the species is not known.

8. Chrysops japonicus, Wiedemann. (Pl. II, fig. 4 & 5.)

(Kuro-Mekura-Abu).

Aussereurop. Zweifl. Ins., I, p. 203, 1828.

Walker, List Dipt. Brit. Mus., V, Suppl. I, p. 291, 1854.

Loew, Verh. Zool.-Bot. Ges. Wien. VIII, p. 621, 1858.

Osten-Sacken, Wien. Entom. Zeitg., III, p. 316, 1884.

Ricardo, Ann. Mag. Nat. Hist. (7), IX, pp. 428 & 430. 1902.

Kertesz, Cat. Dipt., III, p. 189, 1908.

臨時馬疫調査委員會研究成績(馬政局)第二稿, Pl. VIII, fig. 9, 1914.

Matsumura, 大日本害蟲全書後編, p. 70, Pl. X, fig. 10, 1914.

Chrysops aterrimus, Kirby, Ann. Mag. Nat. Hist. (5), XIII, p. 457, 1884.

The large shining black species without any yellowish markings, easily known by the triangular cross-band of the wings.

Female. Head very slightly wider than the thorax. Frons flush with the eyes, very slightly divergent below, at its narrowish part occupying much less than the one-third of the head, all black and shining, depressed across the middle because the ocellar triangle above and the large frontal callus below are conspicuously elevated; the large transverse frontal callus nearly touched the eye-margins leaving an inconspicuous very fine dusted line, almost bare but its upper somewhat semicircular margin furnished with a few black hairs, the depressed part very slightly obscured by a brownish black tomentum and inconspicuously punctulate, bearing a fairly abundant long black pubescence,

which extends up to the vertex excepting of the centre of the ocellar triangle quite bare; just above the antennae a doubly lunulate band of greyish brownish black band extends completely round the antennae and for its full width to the eyes, and is quite bare from the pubescence. Face entirely black shining, without any tomentose parts, furnished with a very few long black hairs which are almost bare on near the outer margin of the facial callus and on just above the mouth-edge; on the inner lower angles of the facial calli a conspicuously deep and rather large pit; jowls moderately convex, covered with an inconspicuous brownish tomentum and bearing fairly abundant long black hairs which extend up to the back of the head and become very short; back of the head only moderately and equally inflated all the way up, black with a conspicuous black ciliation near the eye-margin, and with some rather longer black hairs behind the top corners of the eyes and behind the vertex. Proboscis somewhat stout, shorter than the depth of the head, black very slightly dusted with brownish, and moderately shining on the sucker-flaps, and bearing very short black pubescence except for a few hairs beneath each sucker-flap; palpi almost straight, about as long as the two-thirds of the proboscis, stout, gradually narrowed towards the apex and nearly pointed, black slightly obscured by a greyish brown tomentum and covered with a fairly abundant short brownish black pubescence. Antennae slender, as long as the thorax (without the scutellum), black slightly obscured by a greyish brown tomentum; first joint cylindrical, distinctly longer than the second and slightly thicker, furnished with a somewhat long sloping black pubescence; second joint with similar tomentum and pubescence, but the latter is somewhat denser and shorter, when seen from above there are three fairly distinct annulations; third joint quite bare, moderately upturned at the tip, about as long as the basal two joints together, the first annulation with three or four inconspicuous annulations of which the second one is distinctly dilated near the base. Eyes with the facets all equal, in death brilliant black but in some specimens coppery black,

with four purplish spots and rather broad similar-coloured hind margin which is not very higher up; the middle spot smallest, rounded but with a pointed angle at the anterior margin; the three foremarginal spots larger and placed in equidistant, the middle spot very rounded, not touching the eye-margin and placed just half-way down the eye but slightly above the isolated middle spot, and the lower spot placed above the end of the marginal band and with the somewhat flat upper margin, while the upper spot is somewhat quadrate and placed about the middle of the frontal margin; the three lower spots form an equilateral triangle.

Thorax very short, about as long as its width, shining black with a black pubescence, very slightly obscured by a brownish tomentum, without any stripes; humeri at the lower margin slightly reddish brown; pubescence all black, long, fairly abundant and almost always scuttered uniformly throughout the surface, but slightly denser at the sides; scutellum rather broad, black inconspicuously dusted with brownish, and bearing a scuttered long black pubescence; pleurae black, somewhat obscured by a greyish brown dust which becomes rather conspicuous on the prothorax, mesopleurae, metapleurae, pteropleurae and the upper part of the sternopleurae, these parts being rather densely covered with long black hairs, and the remaining parts furnished with a fairly abundant shorter black pubescence.

Wings rather large, but shorter than the thorax and abdomen together, hyaline with the triangular cross-band and with a narrow apical spot; the former well-defined, broad, its outer side near the base of the upper branch of the cubital fork angularly notched, the rest somewhat straight and ending at before the end of the third veinlet from the discal cell; the inner side of the cross-band slightly convex about the base of the fourth posterior cell, and extends from the end of the outer side to the basal marking, running along the discal vein and occupying throughout the upper basal cell; the apical spot very narrow, slightly notched at both the radial and the upper branch of the cubital

fork, and only crossing the upper branch of the cubital fork at its apex; second basal cell only at the extreme base and along the postical vein clouded; the discal cell in sometimes bearing a fine pale spot in the middle; anal cell usually closed at the margin but in sometimes fairly conspicuously open; the upper branch of the cubital fork about the base slightly curve and without any veinlet. Squame pale brown with a yellowish margin, but in the alar pair the margin is blackish and bears a short conspicuous black fringe.

Legs entirely black, shining but slightly dusted with greyish, rather stout, the pubescence all black, rather abundant and on the femora fairly long; apical spurs black, and pulvilli grey yellowish brown or greyish yellow.

Abdomen long, distinctly longer than the head and thorax (including the scutellum) together, at the base of the second segment broadest fairly conspicuously parallel-sided, with the somewhat rounded anal end, black, shining, very inconspicuously dusted with brownish and covered with a fairly abundant black pubescence which becomes longer at the side of the two basal segments; the belly somewhat dull black furnished with a less long black pubescence.

Length: 10-11.5 mm.

Male. Much like the female. Head somewhat smaller than that in the female; face more convex and more pubescent, shining black, furnished with rather numerous long black hairs all over the face; vertex dull black, elevated, and bearing a rather abundant long black pubescence; frons small, triangular, quite bare, rather shining black with a brownish fore-margin which extends all round the base of the antennae and joins with the brownish middle line of the face, this line being not reach below to the oral margin. Proboscis less stouter; palpi short, about half as long as the proboscis, elevated at right angles to the proboscis, and furnished with much longer and numerous black hairs. Eyes quite bare, touching for less than the middle third of the distance between the occiput and the antennae;

facets on the larger upper part dilated and brownish black in death, but on the smaller lower part small and purplish black, the dividing line being not sharply defined and running across semicircularly so that the small facets extend a long way up the back part. Antennae shorter, with much longer black pubescence on the two basal joints; first joint much stouter, and very slightly longer than the second joint; third joint less stouter and much shorter.

Thorax, abdomen, and legs as in the female, but with more numerous black pubescence; abdomen gradually narrowed towards the apex. Wings with less conspicuous hyaline spaces than in the female, the black colour extending down to the postical vein; the anal and axillary cell infuscate; the apical hyaline space as in the female.

Length: 9.5-10 mm.

In the pasture or fields of the main Island of Japan this species is common, from May to August, and attacks horses but rather rarely cattle. It is noted that *Chrysops japonicus* may be a transmitter of a certain epidemic plague of horses. I have records from Tonezawa (May to August), Tokio (May to July), Kioto (June), Osaka (April to June), and Iwate; while it is known to occure in Amur.

In June this species is one of bothers for rice-farmers, as the female bites any parts of the body, through clothes.

Subfam. **TABANINAE.**

Ocelli often absent or rudimentary, and sometimes even the ocellar tubercle absolutely absent. Proboscis never porrect and elongate. Eyes not pubescent or hairy, in life usually brilliant green, but often banded (in *Tabanus*) or with curious zig-zag-shaped bands (in *Haematopota*); upper and anterior facets often enlarged in the male. Frontal stripe varying from an absence of the callus to a presence of two calli.

Wings almost always not maculated in our species of the

genus *Tabanus*, but blackened in a few species from Formosa; in *Haematopota* however the wings are rather darkened and bear numerous hyaline irregular shaped spots which tend to form incomplete ocelli. Venation simple, but varying as the first posterior cell is widely open or contracting, or closed and sometimes even a short distance before the wing-margin; while the anal cell is usually closed with a rather long petiole; the upper branch of the cubital fork without or with the recurrent veinlet.

Legs without any apical spurs on the hind tibiae, though there are two unequal spurs on the middle tibiae. Touch-hairs almost always present beneath the front tarsi, and often also beneath the end portion of the front tibiae.

Abdomen usually brownish grey or blackish, with from one to three rows of light grey dorsal spots or flecks, or yellowish large lateral spots, or yellowish segmentations.

The only fully recognised character, separating the *Tabaninae* from the *Pangoninae*, lies in the absence of apical spurs to the hind tibiae.

The females of this subfamily are all blood-suckers, but the males may be found sitting on tree-trunks, posts or rails, while some of them hover in bright sunshine, especially in the early morning.

We have five genera and fourty-nine species, in which one genus and 11 species are new from the systematic point of view.

IV. **Haematopota**, Meigen.

Illiger's Magazine, II, p. 267, 1803.

Chrysozona, Meigen, Nouvelle Class., p. 23, 1800.

Small-sized moderately hairy flies of greyish black or greyish brown colour broken up by lighter grey markings and of elongate shape, with peculiarly mottled wings.

Head quite transverse, much broader than the thorax. Frons of the male reduced to a triangle above the antennae as the eyes

touch or almost touch for a long space and with a shining black middle space, and only slightly protruding, but that of the female occupying almost fully one-third the width of the head from the vertex to the antennae and usually greyish with a shining black or blackish callus right across the lower quarter (or more than that) close to the antennae, and above that callus with two widely separated rounded dull black spots, and still further upwards with a smaller (often indistinct) dark spot right out on the middle of the grey part of the frons; vertex not conspicuously elevated, without any ocelli or ocellar triangle. Face light grey, very broad in both sexes, and descending considerably beneath the eyes so as to form broad but rather flat light grey jowls; immediately beneath the antennae there is a fine cross furrow which rises up at the sides and separates the cheeks from the frons, and from which two similar furrows (usually much more narrower than the cross one) descend and separate the very broad shelving light grey side-cheeks from the epistoma, and these furrows end in darkened pits near the mouth margin; the upper part of the side-cheeks usually dotted with small black spots, and pubescence on the face, cheeks, and jowls all long almost erect and pale coloured. Antennae porrect, longer than the head, usually blackish; basal joint more or less dilated especially in the male considerably dilated, as long as or longer than the third joint, and bearing long thin pubescence; second joint short, cup-shaped, and bearing a circlet of short black bristles; third joint elongate, more or less dilated near the base but not humped dorsally, and with its basal annulation tapering to its tip, and with the other three annulations about as wide as the tip of the first annulation and appearing to form a stout blunt style; this first annulation of the third joint is as long as or longer than the other three together, and often appears to be divided again into further sections, while the next two annulations are almost transverse and the last one longer than either of the two previous ones; third joint bare (unless microscopically) except for some tiny black bristles which often occur in an incomplete (mainly dorsal

and ventral) ring near its base. Proboscis prominent, and with the broad sucker-flaps; palpi of the male porrect, with the second joint elongate, ovo-concical, or somewhat pointed, and bearing a long soft pubescence, of the female elongate, pointed, and hanging down against the proboscis. Eyes of the male touching (or almost touching) for a long space, irregularly ovate, densely hairy, and with the facets enlarged except on about the lower quarter and the narrow hind margin; eyes of the female more circular, widely separated and almost bare.

Thorax slightly longer than the width, greyish black or greyish brown (in Japanese species) with light grey stripes which are sometimes indistinct and sometimes resolve themselves after the suture into light grey spots. Pubescence on the notum somewhat long and dense, suberect in the male, but sparse and more depressed and mainly light grey in the female; pubescence on the pleurae longer, shaggier, and paler, excepting on the hypo-pleurae almost bare; no bristles or bristly hairs occur anywhere. Scutellum lying flat on the entirely hidden metanotum, and bearing a pubescence similar to that on the disc of the mesonotum.

Wings peculiarly ornamented by curved hyaline or pale markings on the darker ground colour, though in a few species the markings are very inconspicuous, in repose lying roof-like over the abdomen. Venation of the normal type of the *Tabanidae*, but the upper branch of the cubital fork always with a distinct but short recurrent veinlet near its base; all the posterior cells wide open. Squamae moderately large, the alar pair extending about half-way across the thoracal when they are against each other, thoracal pair outspread aud in no way covering the halteres; and both pairs with distinct margins which bear short fringes which are inconspicuous except for the tuft of long hairs at the angle.

Legs simple; front coxae long, front femora inconspicuously bare beneath; front and hind tibiae without any spurs, but the middle

pair with two unequal spurs; front tibiae and tarsi with touch-hairs beneath in both sexes.

Abdomen about as wide as the thorax but about twice as long as that, almost parallel-sided and rather flat, greyish black or greyish dark brown in the Japanese species, and often with grey spots, flecks, or a dorsal stripe, or even (in the male) with light ferruginous lateral markings near base. Genitalia sometimes conspicuous.

This genus is easily distinguished by its peculiarly mottled wings, its comparatively simple antennae, and its comparatively small size, but the species are exceedingly difficult to separate. In the species, from Japan, Sakhalin and Formosa, all belong to Ricardo's Division IV and they are easily distinguished from each other by the length of the first antennal joint, and the pale marking of the wings.

The described species in the world now amount to more than 150, in which about 64 per cent occur in Africa, about 28 per cent in Asia, about 5 per cent in Europe, and only about three per cent in America; in Australia there is no species of this genus.

In Japan the flies are common on the country road, and are always found when we travel on horse back. The females are most perisistent blood-suckers of both man and beast, especially on hot days, and the males are commonly found resting on timber or rocks, or towards evening on flowers.

At the present time *Haematopota* is represented by only three cognized species in Japan, including both Formosa and Sakhalin, though there is another species described by Bigot (*rufipennis*) which is not known to me.

Key for Species.

1. Hind femora almost unicolorus.
   2. First joint of antennae distinctly shorter than the third joint.
      3. Thorax greyish black with distinct whitish stripes.....
      .... *tristis*, Bigot.

33. Thorax dull black without any stripes.....
.....*sakhalinensis*, Shir. (n. sp.)

22. First joint of antennae slender, as long as the third joint, and thorax with indistinct stripes before the suture.....
.....*formosana*, Shir. (n. sp.)

II. Hind femora at the base and apex black.....
.....*rufipennis*, Bigot. (?)

1. **Haematopota tristis**, Bigot. (Pl. II, fig. 7).

(Gomafu-Abu.)

Bull. Soc. Zool. France. XVI, p. 77, 1891; Mem. Soc. Zool. France, V, p. 628, 1892.

Matsumura, Thous. Ins. Japan, II, p. 72, pl. XXII, fig. 4, 1905; 大日本害蟲全書, 後編, p. 68, Pl. X, fig. 8, 1914.

臨時馬疫調查委員會研究成績(馬政局)第二稿, Pl. VII, fig. 8, 1914.

A common biting fly in northern Japan, easily recognised by rather broad hyaline markings of wings and by rather distinct whitish stripes on the thorax.

Head broader than the broadest part of the thorax. Frons occupying fully one-third the width of the head and very slightly divergent below, yellowish grey with a large shining black callus right across the lower quarter down to the furrow which separates the frons from cheeks, this black callus being moderately convex with somewhat double lunule upper margin which in the middle is somewhat angulate above, and the callus extends downwads between the antennae, but on that part almost always occupying by a rounded dull velvety black spot aud the upper rims of the antennal pits are greyish orange; there are also two large rounded dull velvety black spots a little above the shining black frontal callus which are separated from each other by more than their own diameter but by less than half their diameter

from the eyes (often touching them) and from the black callus; still higher up right on the middle of the grey part of the frons is a small black spot or dot which is very rarely wanted. The black parts of the frons bare, but the greyish part bearing moderate rather inconspicuous sloping pubescence which appears mostly pale and rather conspicuously so just above and below the dull black lateral spot, but is to a large extent black on all the middle part and the black one extends up to the occiput. Face yellowish ashy grey or greyish white, widening out rapidly under the eyes, and the cheeks at the lower half and jowls of almost equal width almost as far as the back of the eyes, though the jowl part retracts rather flatly and is almost half as wide as the depth of the eyes; the upper half of the cheeks dotted with black spots which hardly coalesce and are more conspicuous towards the eye-margin; epistoma pale greyish with a small black spot on each side to the cheeks in addition to the black pit on each side lower down, the pubescence on the epistoma fairly abundant, rather long, and whitish, which becomes more scarce and shorter above. Pubescence on the cheeks similar to that on the epistoma but the somewhat shorter and also scarcer towards its upper margin; the pubescence on the jowls much longer and much denser, and not actually expanded up to the back of the head. Back of the head dark ashy grey and hollowed out, but yellowish grey or whitish grey on a distinct though narrow postocular margin and with a short dense rather yellowish ciliation (just behind the bare eye-rim) which does not become any longer on the upper part and which becomes inconspicuous and sparse behind the vertex. Antennae about one and a half times as long as the head; two basal joints black, but mainly covered with a grey tomentum which leaves only almost the apical one-thirds of the first joint shining black on the upper side and a little more at the lateral sides; first joint moderately dilated for a somewhat considerable length about the middle and apparently three times as long as its broadest part, bearing small black bristle all over and with some thin pale hairs beneath on the basal two-thirds; second

joint short cup-shaped, somewhat extending on the upper side cap-like over the third joint, and bearing black bristles similar to those on the basal joint; third joint longer than the basal two joints together, obscurely brownish red or yellowish brown on the basal half of its first annulation, but its remaining part dull blackish brown or greyish brown, and this first annulation apparently composed of two annulations because of the constriction at about a quarter from the base, is more than three times as long as broad, thickest at about a third from its base but thinner at its base and end than all about its middle, and with several short black bristles above and a few beneath at the end of the constriction near its base; the three terminal annulations of the third joint about as wide as the end of the basal annulation and somewhat tapering, the first two being subquadrate and the terminal one the longest. Proboscis dull black, a little longer than the palpi, with a few pale pubescence on the sucker-flaps beneath. Palpi porrect, pale yellow but obscured by a dense whitish tomentum and very often with a slight blackish hue outside about the basal half of the second joint, while the blackish hue is more pronounced under the white tomentum of the basal joint which bears rather long pale pubescence; second joint very slightly curved forwards, drooping, bearing outside some small black bristles on the apical two-thirds, and with longer pale hairs above and below and about the base, but with all the inside bare. Eyes (when seen from side) almost as long as deep, rather flattened below; pubescence short, sparse, and inconspicuous.

Thorax a little longer than its width, greyish black with five yellowish grey or grey stripes which all begin quite in front, and of which the middle one is narrowest and entire, while the next pair are somewhat interrupted at the suture but are continued to the hind margin; the lateral stripes are very broad and rather vague and divide indistinctly just after the suture but reunite on the posterior part of the postalar callus so as to enclose a greyish black isolated but not well-defined spot; all these stripes are more or less connected with an

inconspicuous narrow similar coloured hind marginal border of the mesonotum ; scutellum all dark brownish grey, bearing only moderate pale pubescence ; pleurae ashy grey, bearing all over long rather silky greyish white pubescence which becomes somewhat denser above. Pubescence on the disc pale greyish yellow, short, rather depressed and rather sparse all over, though several longer erect black hairs occur on the praealar calli and also a few on the disc especially above the wing-bases.

Wings a little shorter than the length of body, marmorated with curved hyaline spots and incomplete ocelli on a pale smoky brown or pale yellowish brown ground colour, and these hyaline markings are varying ; the veins and the stigma brown, but the latter almost always paler and sometimes surrounding with unwell-marked yellowish tinge ; subcostal cell with a distinct complete ring (sometimes entire ocellus) along the outer end of the stigma and with an irregular shaped (sometimes very inconspicuous) hyaline spot touching the inner end ; in the submarginal cell there are three bands interrupted about the middle, a spot, and a ocellus, the latter placed on the base and leaving a very small roundish brownish isolated spot, in the former the first two appear about the middle of the cell so as the recurrent veinlet of the upper branch of the cubital fork is situated in the middle between them but widely separated from each other though they are sometimes connected together along the radial vein so as they make an arch, and the third band is S-like in shape and extends up to the submarginal cell along the costa, and the hyaline spot in the submarginal cell between the first two bands is irregularly roundish and placed between the recurrent veinlet and cubital vein, and sometimes very small or composed of two very small spots ; second submarginal cell with two outwardly curved hyaline bands which are often incomplete and vaguely connected with the last two bands in submarginal cell respectively, but the outer band almost always is rightly connected so as they become a distinct apical band, the small spot very often appear near the base

of the cell; first posterior cell includes two incomplete ocelli, two bands, and an irregularly shaped spot, in the former the first ocellus along the basal angle of the cell is sometimes complete or entire spot and the second one between the base of the upper veinlet from the discal cell and the end of the discal vein isolotes from the cubital vein (or touching it) and never entire below and sometimes interrupted above, the irregular hyaline spot near the base of the lower branch of the cubital vein obscurely continued the second ocellus and often isolates as the second ocellus becomes smaller, the marginal two bands rather distinct and never connected from each other, of which the first is much conspicuous and curved inwards and sinuated (or sometimes distinctly interrupted) about the middle, while the real marginal band along the wingmargin is very often inconspicuous and almost always becomes much more indistinct below; in the second posterior cell there are three isolated hyaline bands in which the last two are quite similar to those in the first posterior cell, the basal one is outwardly curved and sinuated or entirely interrupted about the middle and very rarely becomes an incomplete ocellus, and these three bands are in equidistant; the three bands in the third posterior cell similar to the preceding but the middle band conspicuously nearer to the first than to the third; the fourth posterior cell contains two irregular markings and two quite similar marginal bands, in the former the first one near the base of the cell is very vague, varying in a great extent from a very short broad cross-band to a very imperfect ocellus, and the second hyaline marking almost always is conspicuously curved below like a semicircular ring and its both ends consequently continued the basal band of the third posterior cell and the apical band of the discal cell, and it is sometimes connected with the basal marking and also with the first cross-band; the postical cell possess three cross-bands and two longitudinal bands, the latters placed near the base of the cell and along the longitudinal vein but not extending to the basal cross-band, though they are almost always continued the first cross-band, and

sometimes these bands become two isolated and irregularly shaped spots; the first cross-band of the postical cell just below the basal hyaline marking of the fourth posterior cell is broadest and almost always forms V-shaped hyaline marking with the second band because the latter always is turned upwards at the lower half, and the marginal band is similar to the other marginal ones; in the axillary cell a large irregular hyaline ring and an inconspicuous marginal band, the latter being as long as the just preceding one but sometimes very short and more indistinct, the former occupying more than the basal half along the margins of the cell; there is an other small very vague and incomplete ocellus, touching the outer upper margin of the large ocellus in the axillary cell, this being open at the outer side; the discal cell contains two hyaline markings, the basal one generally composed of two spots of which the second spot forms a rather well-defined broad cross-band and the first one is very small and irregular, these two being connected with a fine very short hyaline rod which is sometimes wanted; the outer somewhat sinuated band in the discal cell slightly curved inwards and rarely formed vague V-shaped marking with the basal cross-band; in the upper basal cell there are two irregular ocelli which are sometimes incomplete, and are connected together along the praefurca or sometimes along both the praefurca and discal vein leaving a small isolated brownish island in the middle of the cell, and the markings in the second basal cell are represented by two quite isolated ocelli separated by the broad brownish part of the cell, which are sometimes incomplete; anal cell mostly hyaline but with two unequal and irregularly shaped brownish spots, which are well-isolated (but one or all sometimes touching the anal vein); costal cell always hyaline; alulae with a large brownish middle spot surrounded by a narrow hyaline band. Squamae rather large, greyish brown with a blackish brown margin in the alar pair, and in the thoracal pair yellowish white with a brown margin, while both pairs have a short inconspicuous grey fringes which develop into a not very conspicuous longer light grey

tuft on the alar pair near the angle. Halteres with a brown or dark brown knob on a dull pale yellow stalk, the former usually whitish on the top.

Legs dull black and pale orange; the orange colour forming broad rings just after the base of the fore tibiae, at the knees of the middle legs, at two-fifth and four-fifth of the middle tibiae, on the basal two-third of the first joint of two posterior tarsi, and on similar parts of the hind legs only more narrowly at the knees; the middle dark ring on the two posterior tibiae more or less brown and not very well-defined; the basal dark ring on the same almost always much more paler than the middle one and more inconspicuous; all the femora obscured by a dense grey tomentum except for the knees quite bare from dust, the pubescence on the front one long and mainly blackish, on the middle femora nearly all yellow but black about the tip, and on the hind femora antero-ventrally long and almost all yellowish but denser and shorter all about the tip, and a small fringe of somewhat bristle-like and black hairs on the ventral margin of the apex of hind femora; front coxae long and strong, much greyer than the femora, and bearing long pubescence which is whitish on more than the basal half but black afterwards and shorter on the outside; posterior coxae short and greyish, and bearing rather long mainly whitish pubescence; front tibiae covered with a short and black pubescence though there are pale hairs on the orange part, and with a very few touch-hairs; middle tibiae with numerous scattered long blackish hairs, and some shorter pale hairs on the typical bands, and bearing two unequal blackish spurs; hind tibiae with a long conspicuous rather dense black dorsal fringe, and with a long finer but almost equally dense ventral fringe, but with rather numerous yellowish hairs almost all over especially on the pale bands; all the tarsi with numerous conspicuous black pubescence and with a few long curved pale hairs at the apical upper margin of the terminal joint, and bearing blackish claws and yellowish brown-grey pulvilli.

Abdomen very much longer than the head and thorax together. Dorsum in a well-marked specimen brownish black, very slightly dusted with greyish, with a moderately broad dorsal line which is almost always inconspicuous on the last segment, with the narrow but conspicuous similar coloured posterior and lateral borders on each segment but on the last segment generally finer and sometimes inconspicuous; and with a pair of less conspicuous moderately large rounded greyish yellow spots on each segment after the two basal ones in the middle of the brownish black space, but these markings always wanted on the seventh segment; in other specimens the grey roundish spots almost always disappear but sometimes very obscurely occur, only on the fourth and fifth segments; the sides somewhat densely covered with a greyish tomentum; pubescence short depressed and mostly black, but more or less greyish yellow on the greyish parts, and longer and less depressed down the side-margins. Ventre darker, yellowish ashy grey or whitish grey with a broad slightly darker basal segments, and with a very narrow yellowish hind margins; pubescence sloping, not dense, and pale except for some erect black hairs under the seventh segment and to a small extent (though less erect) on the sixth segment.

Length: 9–11.5 mm.

Male. Head much broader than the thorax, shorter than the one-third of its width. Face in profile rounded anteriorly and moderately and almost equally produced from the eyes, pale yellowish grey but with the broad side-cheeks thickly speckled all over with small black spots which crowd together so much on the upper part that they coalesce and form an irregular black patch near the antennae; and which become fewer and smaller towards the inner margin of the cheeks, the middle part of the face without any black spots; pubescence on the side-cheeks conspicuous, long but only moderately dense, erect and black, on the middle part of the face and above the mouth the pubescence is less conspicuous and is all whitish yellow; jowls fairly broad, whitish grey and with no black spots except the tiny dots

caused by the roots of the hairs; immediately after the jowls the lower quarter of the back of the head is only slightly inflated and is whitish grey, while a very narrow postocular rim runs up the rest of the back of the head, which however bulges out at the top into the ashy grey slightly inflated sides of the vertical space, these sides being separated by a channel and so much so posteriorly that there is a conspicuous fissure at the middle of the occiput; pubescence on the jowls and all the rest of the neighborhood of the mouth longer, denser, shaggier, and pale yellow, which becomes conspicuously shorter a little up the lower quarter behind an inconspicuous black postocular ciliation; above the lower third of the back of the head this postocular ciliation brows longer and more conspicuous until on nearly the upper half of the head, and it becomes very conspicuously long, black and rather dense right up to and including the vertical space, though the front part of the vertex may very rarely have a few pale hairs; the absolute back of the head is ashy grey, bare, and considerably hollowed out. Frons quite bare, yellowish grey but all the middle part deep black leaving the elongate triangle which extends up between the eyes and is covered with a yellowish grey tomentum being twice as high as broad. Proboscis brownish black, on the stalk there is a long shaggy pale pubescence behind and on the sucker-flaps a few very short dark one; palpi porrect, second joint yellow or yellowish covered with a whitish grey tomentum, elongate somewhat equally ovate very inconspicuously curved near the tip, and bearing abundant but not all dense long pubescence except on the base inner side, and this pubescence is mainly black but to a greater or less extent mostly yellowish white about the base; basal joint darker grey, and bearing similar pale pubescence. Antennae hardly one and a half times as long as the head; basal joint conspicuously dilated, elongate ovate, about twice as long as the width, and shorter than the third joint, shining black but moderately obscured by a whitish grey dust about the base extending on the inner side for slightly more than the basal half, and bearing all over long rather

sparse pubescence which is mostly black but on the underside more or less pale brown ; second joint very short cup-shaped but projected dorsally a considerable distance over the third joint (hardly reaching the end of the basal subannulation of the first annulation of the third joint), blackish, and bearing shorter black bristly hairs ; third joint slender, moderately dilated after the base, paler, the basal annulation about one and a half times of the following three annulations together, rather lurid reddish orange but almost always conspicuously paler about the base, straight about the middle but nearly three times as long as the width of the broadest part and furnished with a number of short black decumbent dorsal bristles at the apex of the basal subannulation and some more beneath ; the other three annulations of the third joint form a dull blackish brown cylinder and bearing a very few microscopical pubescence at the apical margin of each annulation. Eyes in profile shorter than the depth, clothed with rather dense though not very conspicuous moderately long pale brown pubescence, which becomes more sparse and paler on the lower and hinder parts composed of the small facets ; eyes in death dull yellowish brown with blackish green somewhat brilliant tinge on the small facets which occupy less than the lower one-third and about half-way up the narrow back part.

Thorax much shorter and roundish, dull brownish black with three narrow widely separated grey lines commencing quite from the front, of which the middle one is very narrow but well-defined and extended right through to the scutellum, but the side ones not quite so narrow rather less distinct and interrupted at the suture and often become conspicuously grey and broad for only a short distance after the suture (forming a spot) but almost always extended more or less distinctly to the hindmargin ; the lateral band of the disc less distinctly though very broad greyish, but on the praealar calli they are conspicuously greyish, and on the postalar calli and about their neighborhood greyish or brownished grey ; pubescence long and moderately abundant (especially towards the sides), mainly composed of rather sloping

yellowish grey hairs, but with numerous inconspicuous more erect black hairs intermixed. Pleurae dark ashy grey, with a long and shaggy greyish yellow pubescence which is sparse on the lower part and which includes a patch of black hairs on the back part of the mesopleurae, while the pubescence on the upper part of the pleurae is more yellowish and less grey. Scutellum dark grey, and bearing long almost erect black and yellowish hairs intermixed.

Wings brown with similarly mottled pale yellowish hyaline spots which are usually narrow but more distinct. Squamae and halteres as in the female, but the knob of the halteres more whitish on the top.

Legs coloured as in the female. Pubescence very much numerous and longer; front coxae with a long rather fine pale pubescence which becomes usually black and bristly about the apex; front femora bearing mainly blackish and long pubescence, and two posterior femora with nearly all yellow and much longer pubescence which is intermixed with a few short but stouter blackish hairs about the apex; front tibiae with inconspicuous black dorsal ciliation though there are pale hairs on the orange part, and bearing a few touch-hairs, while on the front tarsi there are numerous distinct touch-hairs beneath; middle tibiae with numerous scattered long blackish hairs, and some shorter pale hairs on the pale bands, and bearing two unequal dark yellowish brown (though black tipped) spurs; hind tibiae with a long conspicuous rather dense black dorsal fringe, and with a finer but almost equally dense fringe, but with some pale hairs on the pale bands; all the tarsi closed with a dense rather depressed black pubescence which becomes longer at the dorsal surface, and bearing a very few much longer curved apical hairs on the apical joint above. Pulvilli yellowish grey; claws black.

Abdomen usually narrower than in the female and somewhat bluntly pointed at the apex. Dorsum dull black, with the hind margins of the segments (after the basal one) pale reddish yellow, and the sides of the three basal segment (especially second) brownish red, and the

following segments on the sides narrowly reddish yellow; and indistinct yellowish grey middle line extends from the base of the second segment to near the apex, and an inconspicuous roundish yellowish grey spot on each side of the dorsal line rather above the middle of each segment excepting on the two basal segment and becoming much more indistinct on the sixth segment, while on the seventh segment it is almost always wanted but the segment covered all over with a yellowish dust; the grey dorsal line usually tends to widen into the triangles at the middle of the hind margin of each segment, especially from the fourth segment onwards; pubescence suberect, long but not at all dense, mainly black on the disc but with shorter more sloping pale yellow hairs on the hind margins; side-marginal pubscence long and outstanding and usually all yellowish along the pale margin. Ventre ashy grey with the sides at the basal segments (from the basal segment to the third) yellowish brown, and very often the middle parts of these segments usually slightly brownish; pubescence rather short and sloping on most of the disc but longer about the sides, and longer and more tangled on the two basal segments, and all pale greyish yellow except for the rather numerous erect but curved bristly black hairs on the disc of the seventh segment and more or less on the sixth segment. Genitalia pale ferruginous with a two-jointed lamellae on each side, of which the basal joint is subquadrate and the apical joint half ovate, and these lamellae furnished with a short and fine pale yellowish grey pubescence.

Length: about 10.7 mm.

This species is very closely allied to *H. pluvialis* L., but may be distinguished from the latter by its comparatively long and much more dusted third joint of the antennae in the female, by its more muddy coloured wings, by its large sized body, by its more simple hyaline markings of the wings, and by its much less greyish spots on the abdomen. *H. tristis* is apparently distinguished from the other two species of this genus from Japan by its narrow sinuated hyaline

apical band of the wings, by its entire stripes on the thorax, and by many minor characteristics. Prof. Dr. C. Kertesz placed, in his Catalogus Dipterorum Vol. III, this species as a synonym of *pulvialis*, and in this he was followed by our students, but we find that *tristis* can be fairly well distinguished from three European specimen of *pulvialis* I possess if it is carefully compared with them.

H. tristis Bigot is far too common all over the northern parts of Japan, as the bite of the female is very annoying and, to many people, very painful and persistent. In my own case its bite always lasts five or six days on the actual day of the bite I feel merely a sharp needle prick, and then I do not feel the slightest further effect until the following day when a very slight irritation can be noticed at the spot of the bite, and at night, the spot becomes irritable. On the third day, it swells up and becomes troublesome. On the fourth day it reaches its maximum in size and irritability, then on the following day it suddenly diminishes but at night I often feel similar irritability, though slighter, after that it gradually diminishes, and at last no further effects are felt, although the punctured spot remains on the following three or four days. It is noticed that the female may be a transmitter of a certain infectious disease of horses in northern Japan.

These flies usually occur from about the 20th of May to September, but generally it does not appear in August, except in Hokkaido. I never met these biting flies in rooms even when the house was built in a field or on high land, entirely isolated at a distance from a town or village, or closely connected with pasture.

2. **Haematopota sakhalinensis**, Shir. (n. sp.) (Pl. II, fig. 8.)

(Karafuto-Gomafu-Abu.)

Very small species with entire black thorax, and with rather pale greyish brown wings which are market almost all with incomplete ocelli.

Male. Head apparently broader than the droadest part of the

thorax and much more wider than the three-times of its length. Face in profile moderately rounded anteriorly though sloping up somewhat straight (but not so very well as in the preceding species) from the antennae to the vertex, somewhat much (though equally) produced from the eyes, whitish grey with the black spots all over on the side-cheeks coalescing into a very irregular larger blotch near the antennae; the middle part of the face with no similar black spots but at the side an oblong and oblique black marking along the inner margin of the cheeks; pubescence on the cheeks conspicuous, long but only moderately dense, erect and black, which becomes very slightly shorter towards the inner and lower parts; on the middle part of the face and above the mouth the pubescence is less conspicuous and is all whitish, except for on the black markings quite bare; jowls fairly broad, whitish grey and without any spots, covered with numerous long (though it is slightly shorter than that on the side-cheeks), shaggy greyish white hairs, and on the neighborhood of the mouth there are similar but much more longer greyish white hairs; these hairs do not extend at all up the back of the head, though a shorter pubescence does extend a little up the lower quarter behind an inconspicuous black postocular ciliation; back of the head is ashy grey, almost bare, and considerably hollowed out, but at the lower half the narrow postocular rim is moderately inflated and bearing a conspicuous long black ciliation which becomes longer and more conspicuous towards the vertex.

Frons quite bare, deep velvety black but with a greyish yellow-dusted long triangle between the eyes and with very narrow whitish grey antennal margins. Proboscis thick and dull blackish, the stalk furnished with a rather stout (but curved) erect blackish pubescence beneath and the suker-flaps bearing a few fine pale sloping pubescence on the posterior sides; palpi right erect, pale yellow but densely covered with a grey tomentum, and bearing a long pale pubescence; the basal joint of the palpi very short somewhat spherical, dark grey with a greyish white pubscence; second joint of the palpi oblong, not curved,

at the lower half of the outer surface dark grey but at the rest part pale greyish yellow, the pubescence mostly blackish but about the basal part a very few greyish white hairs intermixed, at the inner sides there is no pubsecence. Anntenae wanting. Eyes touching for about the upper half of the distance between the vertex and antennae, when viewed in profile much deepened and rounded below or less produced to the antennae so that they appear to be apparently deeper than long; facets on the upper part less enlarged than in *Heam. tristis*, the large facets occupying about lower third and its boundary not well-defined; in death yellowish coppery with dark greenish black lower part.

Thorax moderate in size not very much short, black, somewhat velvety black, without any greyish stripes but when seen from a certain direction three very inconspicuous very fine somewhat slivery lines only at the extreme front; prae- and post-alar calli with inconspicuous brownish upper margins; pubescence on the disc somewhat sloping, rather long, pale whitish yellow, with more erect stouter blackish hairs intermixed, on the praealar calli there are rather numerous blackish hairs, with a very few short whitish pubescence about the upper margin; scutellum dull black slightly obscured by a greyish tomentum around the margins, and covered with rather numerous more longer but rather inconspicuous pale whitish yellow pubescence which is intermixed with a very few blackish hairs. Pleurae black but somewhat conspicuously covered with a greyish dust, and bearing a long greyish white pubescence which becomes denser towards the upper part, and on the prothorax, the upper parts of the meso-pleurae and of the meta-pleurae there is a conspicuous tuft composed of somewhat shaggy pale greyish yellow hairs, especially on the prothorax more conspicuous and more whitish.

Wings about as long as the thorax and abdomen together, pale greyish brown with the brown stigma and mostly dark brown veins, and with no hyaline cross-bands excepting of the very inconspicuous sinuated marginal band, but each cell mostly contains only one incom-

plete hyaline ring in the marginal cell there is only one complete (interrupted below) hyaline ocellus just after stigma; the submarginal cell contains two somewhat complete basal ocelli and a large semicircular ring, the formers connected with one other and placed at just the base of the cell along the second and third longitudinal veins while the latter commences at the radial vein just after the ocellus in the marginal cell, obliquely running down to the upper branch of the cubital fork and then along it and obliquely extending up a little to the marginal cell passing the upper apical angle of the cell (though it is interrupted below this angle); the second submarginal cell with an incomplete large ocellus which very broadly opens below and is touching the semicircular ring in the preceding cell along the upper branch of the cubital fork but both ends do not extend so far as they reach the outermargin of wing though its proximal part in a little distance runs along the lower branch of the cubital fork; this ocellus with the upper semicircular are formed a X-shaped mark; in the first posterior cell there are a longitudinal line and an (antero-posteriorly interrupted) incomplete ocellus, the former extending from the base of the cell to its middle along the cubital fork and almost always occupying whole the width of the cell at the basal half and this line has a small not well-defined brownish spot near the base; second, third and fourth posterior cells and postical cell all contain an incomplete (antero-posteriorly interrupted) ocellus in their middle, of which the first two are quite similar and smaller and the last one is large and more roundish, and the third one is not interrupted laterally though somewhat broken out at the upper and lower parts; a large elongate ovate ring in the axillary cell is complete and somewhat pointed posteriorly, and a spot in the discal cell placed about its middle and sometimes may be incised posteriorly; two basal cells with an irregular marking but in the second basal cell it is somewhat conspicuous and large; anal cell greyish hyaline about the basal half in which there is a slightly distinct brownish spot apically; all these markings are greyish

hyaline. Squamae greyish brown with dark brown margin and bearing a very inconspicuous brownish fringe; halteres light fresh yellow with dark brown knob, which has a pale top.

Legs coloured as in *Heam. tristis:* Pubescence numerous and long front coxae with very long shaggy greyish white hairs which become shorter outwards and is sparsely intermixed with a very few sloping short blackish hairs; front femora with a long erect blackish pubescence on the outer and upper sides, which becomes greyish white towards the base, and with a much shorter paler one on the lower side; front tibiae with a moderately depressed short blackish pubescence which becomes longer on the outside, and about the pale ring there is a pale yellowish one; middle femora with a long pale greyish yellow pubescence at the outside and with a short sloping similar coloured one at the remaining sides, and about the apex (especially below) there is a few short but rather stout blackish hairs; middle tibiae covered with long sloping black and greyish yellow hairs of which the blackish one is a little stouter and grows on the blackish parts, and the yellowish one is rather fewer than the former and appears only on the pale reddish yellow rings, these hairs all becoming shorter on the interior and lower sides, the blackish brown spurs being unequal; hind femora furnished with much longer rather erect greyish yellow hairs on the outer and lower sides, and with a depressed short similar coloured (though much more yellowish) pubescence on the rest; hind tibiae with a rather dense and depressed blackish pubescence which becomes shoter and yellow on the outsides, on the other sides there is a very few yellow pubescence about the yellow rings; tarsi in front legs bearing rather numerous touch-hairs; pulvilli greyish yellow, and claws fine and brownished black.

Abdomen dull black, much more longer than the head and thorax (including the scutellum) together, gradually narrowed posteriorly and the discal end slightly pointed. Dorsum on each segment with a narrow greyish orange yellow hind marginal band which extends up

to the lateral margins; two basal segments after the first segment with a large pale ferruginous (more yellowish on the second segment) marking at the sides, without any greyish line or spots; pubescence suberect, long but not at all dense, mainly brownish black on the disc but with shorter more sloping greyish yellow hairs on the hindmargins which become long and outstanding about the lateral margins especially on the second and third segments. Ventre greyish black with a very fine yellowish grey hindmarginal line, and the second segment at the sides being more or less ferruginous; pubescence rather short, sloping on most of the disc but longer about the sides, and longer and more tangled on the two basal segments, all pale greyish yellow except for the numerous erect but curved bristly black hairs on the disc of the seventh segment. Genitalia pale ferruginous with a two-jointed lamella on each side, of which the basal joint is subquadrate and second joint is half ovate, the apical joint furnished with a very few somewhat stout brownish pubescence above and with a somewhat abundant pale yellowish one on the lower part.

Length: 7 mm.

Described from only a single male specimen collected by Dr. S. Isshiki in Sakhalin Island (Ohtani, 22nd of August, 1914), and this species is easily distinguished from all the species described from the oriental region by its peculiarly marked wings. I do not know of its habits.

3. **Haematopota formosana** Shir. (n. sp.) (Pl. II, fig. 6; Pl. IX, figs. 7 & 8).

(Taiwan-Gomafu-Abu.)

Middle sized greyish brown species with the long and slender antennae, and with the brown wings ornamented by rather small hyaline spots and a distinct hyaline apical band.

Female. Head broader than the thorax, and about as long as the one-third of its width, greyish yellow. Frons broad, occupying fully one-third the width of the head and slightly widening from the occiput to the antennae, yellowish grey with a large very inconspicuous

flat V-shaped dark marking in the middle which touches the frontal callus at its angle and hardly extends the eyemargins above the middle of the length of the frons; a trace of the ocellar portion between both wings of the V-shaped marking conspicuously greyish with a minute brown dot in the centre, and faintly extends up to the occiput; frontal callus shining dark brown though it becomes gradually paler anteriorly, with a blunt angular upper margin and with a velvety blackish brown spot between the antennae, occupying fully the lower quarter of the frons, and extending downwards between the antennae and down to the furrow which separates the frons from the cheeks leaving the greyish yellow rims around the antennal pits, and in profile moderately raised; between the inconspicuous V-shaped marking and the frontal callus there are two large roundish dull velvety blackish spots which are broadly separated from each other by a little less than the twice their own diameter but by a very narrow line from the eyes and from the callus; pubescence short and depressed, scattered all over the surface of frons except for the blackish callus only, mostly black but round the velvety spot there are a very few minute greyish white hairs especially on the upper part of its spots; vertex slightly dark but somewhat conspicuously lighter than the V-shaped marking, bearing a rather dense similar but slightly longer and less sloping pubescence which marges into a very few inconspicuous whitish pubescence about the upper part of the occiput. Face rather whitish grey though slightly yellowish, widening out rapidly under the eyes and the cheeks and the joints of almost equal width almost as far as the back of the eyes, though the jowl part retreats rather flatly and is almost half as wide as the depth of the eyes; less than the upper half of the side-cheeks dotted with brownish black spots which crowd together at the both ends so as there are two blackish spots on the top of the cheeks and about its middle, of which the top one is irregularly shaped and is much smaller, while the lower one is a rather well-defind transverse and somewhat crescent-shaped spot and extends from the eyemargin to near the inner apical roundish angle

of the cheek; this transverse spot is broadest at the eyemargin, gradually narrowed towards the other ends, and separated from the top blackish spot by a narrow greyish white but very sparsely dotted with blackish crescent; epistoma yellowish grey-white, broader than the side-cheek, with a rather small roundish black pit on each side. Epistoma, cheeks, jowls, etc., all clothed with a somewhat abundant but not very long whitish (rather silvery) pubescence which becomes much longer and much more conspicuous on the jowls; just above the middle of epistoma there is a row, composed of about six conspicuous long sloping curving blackish somewhat bristly hairs, and about the upper half of the side-cheeks there is a few long blackish pubescence. Back of the head yellowish grey on the distinct though very narrow postocular margin and with a very short pale brownish yellow ciliation (just behind the bare eye-rim) which becomes darker and slightly longer upwards and which becomes inconspicuous and sparse behind the vertex; the actual back of the head ashy grey, hollowed out and almost entirely bare from pubescence but about the lower quarter bearing a very sparse short and fine whitish pubescence which merges into the long hairs on the jowls. Proboscis longer than the depth of the head, moderately stout, brownish black, with a slightly sloping rather long brown hairs behind the stalk and with a very few much more erect, a little stouter blackish pubescence on the posterior surface of the sucker-flaps; palpi slender long but shorter than the proboscis, pale yellow but obscured by a greyish white tomentum and with a slight brownish hue outside the second joint, while the brownish hue is more pronounced under the whitish dust of the basal joint; palpi slightly curved, second joint dilated less than the basal two-thirds but broadest near the base, bearing outside a fairly abundant black pubescence which becomes longer and less sloping above, and there is a few rather inconspicuous pale greyish pubescence behind and about the base, but which all the inside bare; basal joint bearing a rather long pale pubescence. Antennae long and slender, brownish black with the basal joint reddish yellow oi

reddish black; first joint as long as the third joint, cylindrical but the both ends slightly narrow, slightly shining and gradually darkened towards the apex, bearing rather short depressed blackish pubescence which grows longer and less sloping beneath; second joint very small cup-shaped, moderately extending on the upper side cap-like over the third joint, and bearing black bristles similar to those on the apex of the third joint; third joint dull black not shining, its basal annulation more than the twice as long as the following annulations together, somewhat depressed laterally, when seen from side about as wide as the first joint and when seen from above conspicuously narrower though its basal subannulation sightly narrower at the apex, this basal subannulation occupying less than the basal one-third of the first annulation and bearing a somewhat complete circlet of very short black bristles; three apical annulations of the third joint all velvety black and bearing a very few microscopical pubescence, in which the first two annulations are equal in size and slightly broader than their length, but the last one apparently longer than its width and with the blunt apex. Eyes almost bare from pubescence, when seen sideways almost as long as deep, rather convex below; in death dark purplish black, without any distinct markings.

Thorax moderate in size, brown above and ashy grey beneath. Dorsum at the anterior part slightly grey and with an indistinct grey band at the posterior margin, three distinct though narrow greyish white middle stripes extending from the apical extremity to conspicuously before the suture, in which the middle one apparently is narrower than the lateral ones; there are two very inconspicuous greyish somewhat triangular spots at the suture; humeri apparently greyish, bearing a rather conspicuous tuft of long pale brownish hairs; prae and post-alar calli somewhat lighter than the disc, and the former bearing an abundant long black pubescence which is intermixed with very short pale yellowish rather shining hairs above, and the latter pubescent as in the disc of the mesonotum; pubescence on the disc rather short but

rather stout and numerous, black and pale shining yellow, the black one much more numerous, stout and sloping, and the yellow one despressed, and wanted about the apical greyish part, but on the grey hindmarginal band very abundant; scutellum brown, bearing a numerous sloping pale yellow pubescence which is intermixed with conspicuous short less sloping slightly curved black hairs. Pleurae ashy grey with numerous greyish white pubescence which becomes longer and shaggier above.

Wings about as long as the thorax and abdomen together, brownish with brown veins and stigma, the hyaline markings being similar to those in *Haem. unizonata* from Ceylon but more distinct and more spotted; in the costal cell there is a very faint greyish spot just before the apical angle, while the marginal cell contains a perfect ocelli touching the apex of the stigma and a large but very inconspicuous spot just below the top of the costal cell; in the submarginal cell there are four narrow cross bands and three small spots, the first spot at the base somewhat transversely oblong and with pointed ends, the second spot occupied the space between the recurrent veinlet of the upper branch of the cubital fork and its stem but not touching the base of the upper branch, and the third spot just above the recurrent veinlet somewhat transversely oblong and apparently smaller than the second one; the hyaline cross bands in the submarginal cell almost equidistant, of which the broadest and entire apical one curves inwards and extends from just after the end of the radial vein to just after the basal two-thirds the upper branch of the cubital fork, the first band is very slightly curved outwards and the distance from it to the basal spot is less than the length of the latter, the second one placed just before the ocellus in the marginal cell, curving inwards and distinctly interrupted at the middle, and the third placed a little far apart after the ocellus in the marginal cell, sloping and curving outwards and completely interrupted at the middle; second submarginal cell contains two incomplete cross-bands, and two spots of which the basal one is not touched

the basal margin of the cell and the other spot is placed just before the marginal band of the first posterior cell along the lower branch of the cubital fork, the first band between these two spots distinctly interrupted at the middle and curved outwardly, and the second band is obliquely divided into spots by a rather broad brown interval (but in the other specimen slightly connected only at its outer border), and with the last band in the submarginal cell forms a distinct apical band though it extends below the middle of the wing margin in the cell; the first posterior cell with five imperfect cross bands and two spots, in the formers the short and broadest first band appears just after the basal band in the submarginal cell, the second one interrupted is not reached the upper margin of the cell but bents almost right-angularly at the interrupted portion running towards the apex of wing a short distance before the third cross-band which is slightly sinuated and composed of up and down quadrate spots and which is placed between the second spot (just below the recurrent veinlet) in the submarginal cell and the basal spot in the second posterior cell, the interrupted fourth cross band just after the first band in the second submarginal cell curved inwards and extends below to the upper veinlet from the discal cell very little before the marginal band in the second posterior cell, the apical band rather conspicuous replaced by a single short spot near the upper apical angle of the cell; the basal spot in the first posterior cell occupies the extreme base of the cell, while the other spot appears about the basal spot in the second submarginal cell and extends right below to the middle of the cell; in the second and third posterior cells there are only six isolated spots in which the middle four ones form two cross-bands and the other two spots are placed at the base and apex of the cell, the latter representing the marginal band and more conspicuous and larger than that in the preceding cell respectively, the middle two cross bands in the third posterior cell less apart than those in the second posterior cell; fourth posterior cell possess two incomplete cross-bands, and three spots of which the largest basal one is placed

near the basal margin of the cell and the others are very small somewhat triangular and placed between the two cross-bands in about the some distance from the base of the third veinlet from the discal cell but distinctly nearer to the bands than to the basal point of the third veinlet, the two cross-bands slightly interrupted about its middle of which the apical one situates just after the first cross-band in the third posterior cell; there is no apical band in the fourth posterior cell; the postical cell contains three incomplete cross-bands and a faint apical band which occupies only the upper half the outer margin of the cell, each of the three cross-bands composed of two small spots separated for a long distance about the middle and all the cross-bands somewhat equidistant; in the upper basal ceil there are four hyaline markings of which the middle straight two become rather complete broad quite isolated cross-bands and the others appear as the basal and apical spots; the hyaline markings in the second basal cell are the same in number to those in the upper cell but quite distinguished from them by the shapes, the apical spot being as an incomplete ocellus placed just before the base of the postical cell, while the basal spot is almost always faint, and the first hardly interrupted one in the middle two cross-bands placed below between the basal spot and first cross-band in the upper basal cell and slightly curved outwards, and the second band in the cell extending from before the basal angle of the discal cell to after the two-thirds of the postical vein and curved inwards; anal cell with three bands, of which first one is not interruped and the second one is angulately sinuated outwards at its middle and is placed about the middle of the cell, while the third cross-band is replaced by two (upper and below) quite isolated spots which are respectively touching the lower branch of the postical fork and the anal vein, at the apical angle of the anal cell an other faint spot; in the axillary cell there are three cross-bands, of which the middle one is longest and somewhat zig-zag-shaped and extends from just below the middle sinuated band in the anal cell to the apex of the axillary vein, while the basal cross-band is somewhat

crescent and extends from after the basal cross-band in the anal cell to the actual end of the axillary vein; along the apical margin of the axillary cell an inconspicuous narrow marginal band from the apical angle of the cell to the middle of the margin between the end of the anal vein and the end of the axillary vein. Squamae pale greyish yellow with the very short inconspicuous whitish fringes; halteres pale yellow with the blackish knob which has a narrow yellowish margin.

Legs not uniform in colour, mostly more or less brown or dark brown, moderately pubescent, with the typical rings on the middle tibiae only, and all tibiae more or less white near the base; front coxae moderately dilated about the middle, yellowish brown but somewhat densely obscured by a grey dust, and bearing a depressed greyish white pubescence which becomes longer and denser about the basal half (especially on the anterior side) like that in the prothorax; front femora brown but slightly covered with a greyish tomentum, becoming darker apically, slightly curved twice (first above and next below), bearing a depressed rather short blackish pubescence which becomes less slopy and longer outside and which is mostly replaced by greyish hairs about the outside of the basal half, on the lower margin of about the apical one-third there are two conspicuous fringes of the sloping stout blackish hairs, of which the interior fringe more conspicuous and longer; front tibiae dark brown with a greyish band about the basal one-third and this band is not well defined, compressed laterally, with a short depressed numerous blackish pubescence all over which becomes slightly longer outside, and about the lower apical end there are a very few long pale touch-hairs; front tarsi uniformly dull black, bearing the rather conspicuous long pale touch-hairs; middle femora pale yellowish brown, slightly dusted with grey outside, and becoming a little darker towards the apex, bearing a fine whitish pubescence which becomes longer outside and which is intermixed with a very few short but stout blackish hairs; middle tibiae brown with two narrow pale rings, of which the basal one is narrower and less conspicuous than the second

ring, bearing a short depressed and blackish pubescence and on the pale rings mostly yellowish white, and bearing two unequal rather stout blackish spurs; hind femora yellowish brown, darker about the apex, bearing a rather short depressed blackish pubescence which becomes gradually longer and denser towards the apex and is intermixed with whitish hairs about the base especially on the upper surface (but leaving a short apical part) and on the lower basal half, on the apical lower one-fourth there is a very conspicuous dense fringe of long stout black hairs; hind tibiae dark brown with a somewhat broad greyish yellow ring near the base and also with a very inconspicuous pale yellowish brown band, bearing a depressed blackish pubescence all over the tibiae which forms a conspicuous fringe at the upper margin, except for on the basal pale ring almost all whitish, and at the four-sixth there is an inconspicuous patch of a few short whitish pubescence; posterior two pairs of tarsi bearing a conspicuous long distinctly curved stout hairs and a few similar (though shorter and less stouter) hairs about the dorsal apex; pulvilli pale yellowish brown, and claws blackish.

Abdomen rather slender, about twice as long as the head and thorax (including the scutellum) together. Dorsum brownish black with the middle line and hind marginal band ashy grey, the former extending from the hind margin of the first segment to the sixth or seventh segment, and the latter occuring on each segment but on the fourth to seventh segments very narrow and slightly yellowish and on the first segment only about the middle of the posterior margin; there is an other ashy grey band on the basal margin of the first segment, and on each side of the middle line there is an inconspicuous somewhat roundish pale greyish yellow spot but on the three basal segments wanted; the sides of each segment more or less ashy grey, especially the basal segment with the large ashy grey lateral marking; pubescence almost all depressed, short and blackish, but on the greyish marginal bands there is a few greyish yellow-white pubescence which becomes slightly longer and less sloping at the basal sides. Ventre ashy grey,

but gradually becomes darker to brown, with a narrow pale yellowish white actual-hind-marginal band on each segment; pubescence mostly greyish white but gradually becomes brownish behind, and on the disc of the apical segment there are rather abundant long and erect brownish black hairs which somewhat extend up to the preceding segment.

Lenth: 9.5-11.3 mm.

Described from four females in my collection from Kosempo in the prefecture of Ako and from Tauran in the Shinchiku-prefecture in Formosa.

According to Ricardo's table this species falls in the Group III, and it is allied to her *unizonata* from Ceylon, but is certainly distinct from it, and from any other species belonging to that Group. The wing-pattern has a great resemblance in general to that of *singalensis* from Ceylon, and rather less to *unizonata*, and the greyish markings on the thorax are more similar to the former species than to the latter, while the antennae and legs are very closely allied to *unizonata*. This handsome fly bites me severely on the back, through a thin shirt, when I was sitting on the bridge across a stream near Kosempo in the midday of a day in July. It was a very hot and brilliant day, and its bite was very painful, and was irritable for about five consecutive days. I noticed afterwards that the punctured spot remained visible for about a fortnight. In the same month I caught a single fly, which was resting on the belly of Formosan cattle.

4. **Haematopota rufipennis**, Bigot.

Bull. Soc. Zool. France, XVI, p. 77, 1891; Mem. Soc. Zool. France, V, p. 628, 1892.

Wings brownish, with indistinct pale spots; abdomen with fine yellowish incisions; legs reddish. Length: 11 mm.

Antennae, palpi, face and frons black, the latter wide; callus broad and shining black; third antennal joint at the base reddish; body black; squamae and halteres pale reddish yellow, the latter with knob

dusky; coxae black; legs tawny, front and middle femora, apex of the tibiae broadly and tarsi, black; apex and base of the hind femora, an annulation and apex of the hind tibiae, and apex of the tarsi, black; wings brownish, with pale whitish spots, and with the stigma black. Described from only one female from Japan.

This species is not known to me, but is may be distinguished from other species by its reddish hind femora with the apex and base black.

V. TABANUS (sensu lato)

Linne, Syst. Nat., ed. X, T. i, 601, 1758.

Moderately pubescent flies of usually brownish black or grey colour or orange yellow, but sometimes with brownish ferruginous or conspicuous reddish orange markings and usually with longitudinal rows of grey spots or flecks on the abdomen, in size varying in a great extent, from more than 20 mm. to 8 mm.

Head as broad as or broader than the broadest part of the thorax, in the male much more convex than in the female. Frons in the female rather narrow, extend from the vertex to the antennae, being known as the frontal stripe which is from two to eleven times longer than broad, but in the male very short, limited to a triangle above the antennae which extends up to a point between eyes as the frontal triangle; frontal stripe parallel-sided or divergent, very often bearing some spaces denuded of dust or pubescence, which are known as the frontal calli, and of these the lower one occupying a position above (not just above) the antennae, and the other one placed at about the middle of the frontal stripe and varying specifically in shape (sometimes wanted) from quadrate to linear, and very frequently connected with the lower callus by a narrow line; there is very seldom two other distinct calli of which a large one appears at immediately above the antennae and a small one on the vertex; the former is usually

known as the frontal triangle and the latter as the ocelligerous tubercle. Face broad, with broad cheeks all down the sides which are much more prominent than the epistoma and the cheeks bear more or less bushy pubescence which continues on to the jowls and thence to the lower part of the back of the head; upper part of the back of the head is hollowed, but the eye-marginal area is usually very little puffed out in the female. Ocelli present or absent, but never conspicuous. Proboscis powerful, produced, and bearing rather large sucker-flaps which are usually furnished with a few short pubescence beneath. Palpi very conspicuous, two-jointed; basal joint short ovate and bearing a long pubescence; second joint elongate, in the male globular and outstanding with a more or less blunt tip, and bearing a rather long pubescence, in the female cylindrical and drooping to a point, lying on the proboscis and mainly covered with rather depressed bristle-like hairs. Antennae three-jointed, yellowish to blackish, in the female roughly as long as, or in the male almost always distinctly shorter than the head; basal joint short but longer than the second, and often produced cap-like over the base of the second, bearing numerous short usually black bristle-like hairs and usually some rather longer thin pubescence; second joint very small somewhat cup-shaped, and furnished with abundant short black bristles placed more or less in a subterminal circlet; third joint elongate and five-annulated, the apical four annulations forming a very stout style, the basal annulation large and long, enlarged about its base and bearing on its upper side before or at the middle a peculiar hump which varies in an extent from a moderately raised hump to an arched hood. Eyes large, practically bare, or distinctly pubescent, or sometimes only indistinctly pubescent in one or both sexes; in the male usually conspicuously large, and touching for a long space, while in the female quite separated by the frontal stripe; eyes in life brilliant coloured in some iridescent or opalescent tint of green, and usually with purplish transverse bands; the eye-facets in the female all equal but in the male often conspicuously or moderately enlarged on the

front and upper parts and the amount of this enlarging specifically varying in a certain extent.

Thorax thick and short, quadrate with rounded angles; humeri distinct and round, clothed with a dense tomentum which is usually paler than that on the disc of the thorax; praealar calli large and roundish though its inner end almost always pointed, and often rather differently coloured from the disc of the thorax; postalar calli obliquely transverse between the base of the wing and the scutellum. Pubescence on the disc rather inconspicuous and usually composed of two distinct kinds of hairs, of which one kind stands erect over most of the disc and scutellum but does not exist on the front part of the disc, while the other kind is pale and lies more depressed all over the disc and at least round about the margin of the scutellum and is much thinner and more liable to be rubbed or worn away than the erect hairs; in addition to these there are patches of depressed pale hairs above the wing-bases and against the postalar calli; pleurae with longer shaggier pubescence especially on the upper part.

Wings usually hyaline though more or less infumated, rarely spotted or marked in any way, and with scarcely any deviation from the typical form of the *Tabanidae*, except that the upper branch of the cubital fork has sometimes a recurrent veinlet near its base as in many *Chrysops* and *Haematopota*; posterior cells normally open, but the first one narrowed or even occasionally closed; anal cell closed; wing-membrane rippled all over, practically glabrous. Alulae strongly developed, and so large that when the wings are at rest they are pushed upright against the sides of the scutellum. Squamae very well developed, and with darker margins which bear a very short fringe except on the alar pair near the angle where there is a conspicuous tuft of long hairs; thoracal pair largest but outspread or elevated and not concealing the halteres. Halteres moderate.

Legs simple, but with two almost always unequal apical spurs on the middle tibiae; front coxae long, being fully two-thirds as long

as the femora; femora dull, covered all over with soft pubescence except along the minutely transversely striate often sunken underside of the front femora and on a streak at the inner apical quarter of the hind femora, these parts being bare and moderately shining; front tibiae about the apex and the front tarsi beneath or about the side with peculiar touch-hairs.

Abdomen as broad as or slightly broader but hardly longer than the thorax, moderately flattened, gradually narrowed towards the apex especially on the male which is more or less pointed. Pubescence short and depressed, rather abundant (though it is not conspicuous), but very easily rubbed away; the pubescence on the disc of each segment is usually shorter than that on the hind margin, and is more or less longer towards the apex and sides; pubescence on the ventral side is almost always more conspicuous than that on the dorsum, and on the seventh segment there is always some distinct erect blackish bristly hairs. Genitalia two-jointed, the basal segment somewhat quadrate and the second segment half-ovate.

The larvae are usually a semiaquatic creature (but sometimes aquatic), living in damp earth, in sand, or under decaying leaves and stalks on damp earth or sometimes in water, and they feed on dead or living soft bodied creature or decaying vegetable matter. The larvae circular in transverse section, elongate, tapering at both ends, and with a swelling ring near the anterior margin of each segment except on the first three segments and the two apical ones; head very small, retractile; posterior respiratory organs placed in a vertical cleft and closed together.

Pupa slender, gradually narrowed apically; head without projecting thorns; thorax with the sessile respiratory organs which are connected subcutaneously with a large cavity on each side of median line close to anterior margin of prothorax. Abdomen bearing one or two closely placed series of short bristles on each segment except on the first, and a somewhat inconspicuous transverse series on ventral

segments; apical segment with six stout processes which are more or less radiated and pointed.

According to a few Dipterogists the females lay their eggs in a cluster on the stems or leaves of a certain plants growing on the marshy field.

The flies commonly seen around pasturing animals, or siting on tree-trunks; the females usually attack cattle or horses, or even sometimes the back of human beings, while the males usually occur resting on leaves or on ranks, and hover in the sunshine in the early morning even before sunrise, especially in mountainous regions. I never met any males of this genus flying in the evening as *Chrysops* do.

Tabanus (including *Therioplectes* and *Atylotus*) is a very widely distributed genus and contains about 1110 rather distinct species all over the world; about 285 species are known to occur in Asia (and more than 120 species are recorded from the oriental region), of which 44 species belong to Japanese fauna; about 73 species have been recorded from Europe, about 142 species from Africa, over 485 from America, and about 72 from Australia and New Zealand.

Subg. **Therioplectes**, Zell.

Isis, XI, p. 819, 1842.

Head of the male not differing much in size or shape from that of the female; eyes of the both sexes distinctly pubescent with the cross-bands, the facets in the male sometimes uniform or sometimes very moderately or distinctly different in size; ocelligerous tubercle more or less distinct.

There are only four distinct species from Japan, in which three species occur in Europe, and another species, *hirticeps* Loew, is known only in Hokkaido and Sakhalin.

Key for Species.

I. Body large and robust, more than 20 mm. in length; legs reddish yellow with the basal two-thirds of femora blackish; abdomen dense-

ly covered with a golden yellow pubescence at the broad hind margin of each segment..... *tarandinus*, Linne.

II. Body moderate, less than 20 mm. in length; abdomen without distinct haired segmentations.

2. Rather small-sized species of black, with three rows of indistinct greyish spots on the dorsal abdomen, legs entirely blackish..... ..... *hirticeps*, Loew.

22. Blackish medium-sized species, with reddish yellow or dull orange yellow lateral markings on the abdomen.

3. Abdomen mainly blackish grey or black, with only moderate light lateral markings near base; eyes of the male in life with three purplish bands ..... *tropicus*, Panzer.

33. Abdomen mainly reddish orange, with a black dorsal stripe; eyes of the male in life with two purplish bands .... *distinguendus*, Verral.

1. **Therioplectes tarandinus**, Linne. (Pl. III, fig. 2.)

(Karafuto-Aka-Abu).

Tabanus tarandinus, Linne, Syst. Nat., ed. XII, 2, p. 1000, 1767; Suec., p. 462, 1884.

Mueller, Zoolog. Dan prodr., p. 179, 1776.

Fabricius, Spec. Insect., II, p. 457, 1781; Entom. Syst., IV, p. 364, 1794; Syst. Antliat., p. 95, 1805.

Gmelin, Syst. Nat., V, p. 2882, 1792.

Meigen, Klassif., I, p. 171, 1804; Syst. Beschr., II, p. 44, 1820.

Fallen, Kongl. vet. Akad. Handl., XXX, p. 240, 1809; Dipt. Suec., Taban., p. 4, 1817.

Duncan, Magaz. Zoolog. & Botan., I, p. 364, 1837.

Zetterstedt, Insecta Lappon., Dipt., p. 513, 1838; Dipt., Scand., VIII. p. 2937, 1849; Dipt. Scand., XI, p. 4259, 1854.

Gimm., Bull. Soc. Imp. Nat. Moscou, XX, 1, p. 184, 1847.

Frichson, in Middendorf: Reise in Sibir., II, p. 66, 1851.

Loew, Verh. Zool.-Bot. Ges. Wien, VIII, p. 585, 1858.

Bonsd., Finl. Tvaving. Ins., I, p. 108, 1861.

Brauer, Denkscer. Akad. Wien XLII, p. 139, pl. 1, fig. 3, 1880.

Speiser, Zeitschr. Wiss. Insektenbiol., 1, p. 407, 1904; Schrift. Physik.-Oekon. Ges. Koenigsberg, XLVI, p. 163, 1905.

Villeneuve, Ann. Soc. Entom. France, LXXIV, p. 309, 1905.

Kertesz, Cat. Dipt., III, p. 284, 1908.

Therioplectes trandinus Kertesz, Zoolog. Ergebn. Asiat, Forshungsr. Grafen E. Zichy, II, p. 191, fig. 5, 1901.

Verrall, Brit. Fl., V, p. 760, 1909.

Tabanus tarandicus, Vill.. Ent. Linn., III, p. 552, 1789.

Tabanus karafutonis, Matsumura, Journ. Coll. Agr. Tohoku Imp. Univ., Sapporo, Japan, IV, 1, p. 64, pl. II, fig. 14, 1911.

A large robust handsome species, distinguished from any other Japanese species of the genus *Tabanus* (sens. lat.) by the hindmargins of the abdominal segments with a distinct golden yellow pubescence.

Female. Head very short but slightly broader than the thorax, somewhat arched. Frontal stripe broad, slightly narrowed rather rapidly about the lower one-third though the remaining part is parallel-sided, about three and a half times as long as its broad, with two frontal calli, in which the lower one is larger, roundish, moderately convex, occupying more than the middle three-fifths of the space between the eye-angles, reddish brown but darker above, shining though minutely striolate, while the upper one is rather inconspicuous, long, narrow, and shining black; these two calli sometimes connected with a ocelligerous tubercle reddish brown, small though distinct and sharply elevated, situated just front the occiput; frontal stripe black but densely obscured by a yellow or pale yellowish grey dust (leaving all the callosities) and bearing somewhat long dense sloping brownish yellow or yellow pubescence with a few similar blackish hairs intermixed, leaving a narrow median line from the ocelligerous tubercle to the lower callus so that the callosities all seen to be connected with a narrow blackish line; frontal

triangle quite bare and shining deep reddish brown with the upper border blackish, but greyish yellow at the double lunule just above the antennae and about the eye-margins, moderately raised before the level of the eye-margins, with a distinct though very narrow longitudinal median furrow which becomes very deep just above and between the antennae as its lateral edges are conspicuously elevated, and with a distinct narrow very shallow transverse furrow between the eye-angles; occiput reddish yellow or ashy brownish grey, clothed with abundant long curved deep yellow hairs which are intermixed with a few similar, but stouter and black, hairs (in the formosan species the black hairs are very conspicuous). Face very broad, puffed out of the eye-margins, blackish but densely obscured by a greyish yellow tomentum (sometimes less dusted on the epistoma), bearing long and somewhat bushy yellow or deep yellow pubscense on the side-cheeks, and bearing longer but sparser yellow or deep yellow hairs on the epistoma, in the Formosan form the pubescence intermixed with a very few similar though stouter black hairs at the upper lateral elevated parts of the epistoma; jowls and the back of the mouth with dense very long shaggy deeper coloured hairs; jowls under the eyes at the back part and the back of the head right up to the vertex moderately and somewhat equally puffed out, greyish yellow, and bearieg a rather short brownish yellow ciliation all along near the eyes leaving a narrow ashy yellowish grey postocular rim, and behind this brownish ciliation (especially near the upper part) is a long straggly yellow pubescence. Proboscis stout, shorter than the depth of the head, deep black, with a few rather conspicuous long erect brownish yellow pubescence behind the stalk; palpi deep reddish yellow, about two-thirds as the proboscis; first joint very short, darker on the outside, bearing an abundant long shaggy golden yellow pubescence similar to that on the mouth-edge; second joint broad at the base but rather quickly attenuating after the band to a blunt tip, about four times as long as the thick part is deep, densely clothed with short depressed brownish yellow pubescence intermixed with a few

tiny though conspicuous scattered black bristles on the outer side, the black bristles being often disappeared and bearing a few very tiny brown or blackish bristles on the apex. Antennae a little shorter than the length of the head, deep reddish yellow; basal joint dilated rapidly after its base, slightly dusted with grey, somewhat sparsely clothed with long brownish yellow hairs, and bearing a few conspicuous black bristles about the apex especially on the upper and lower parts; second joint very short, flat cup-shaped, considerably though very narrowly produced above the half-way to the point of the dorsal hump of the third joint, as it has a spine at the upper apical margin, and bearing incomplete apical circlet of short black bristles; third joint about two and a half times as long as two basal joints together, its basal annulaton considerably dilated about the basal half, conspicuously incised above, so that the angle conspicuously projects, this angle being just before the middle of the annulation and without any distinct bristles, the style-like portion a little shorter than the basal one and with a longer concial apical annulation. Eyes clothed with a short dense whitish pubescence, but almost or quite bare along the very broad hind border, in profile conspicuously curved below and about one and a half times as deep as wide, and when viewed from front slightly broader than it is deep; eyes in death black, with three equidistant narrow deep purplish transverse bands in which the middle one extends from the frontal angle to above the hind angle and is straight, while the others respectively from about the middle of the lower two-thirds of the frontal margin or from above the facial margin to the hind margin, but the both rapidly bent below or above and hardly fused into the middle band near or at the hind margin; facets all small and equal.

Thorax short but stout, roundish, somewhat shining, greyish black, very slightly brownish grey at the anterior border, with three very inconspicuous (although it is well-preserved specimens) narrow greyish middle stripes about the centre of the disc in which the middle ashy

grey one is slightly broader and somewhat conspicuous, and the outer greyish yellow ones appear only a short distance after the suture, on the sides there is a very faint slightly broad greyish stripe which occurs only before and after the praealar calli which are reddish brown and bear abundant and dense long tangled deep golden yellow hairs; above the wing-bases reddish brown in a small part and bearing a long dense somewhat depressed tuft of the similar hairs; postalar calli somewhat brownish aud covered with the hairs similar to those above the wing-bases; humeri greyish brown, clothed with an abundant shaggy pubescence; pubescence on the disc short depressed deep orange yellow, which is intermixed with numerous long and erect, black hairs but on the front part almost all erect and yellow, without any depressed pubescence; the black pubescence extending on the upper parts of the praealar calli and of the wing-bases and becoming much numerous about the hind margin of thorax; scutellum clothed almost only with abundant long sloping deep orange yellow hairs but sometimes about the margins there is a very few black similar hairs. Pleurae deep blackish, slightly brownish towards the upper border, with mainly dense shaggy black or brownish black pubescence but there is a dense tuft on the prothorax, on the upper-hind parts of the meso- and meta-pleurae with conspicuous deep orange yellow or reddish brown hairs (sometimes with black hairs intermixed).

Wings hyaline, slightly greyish, but yellowish about the base and towards the costa, and yellowish brown about the sides of all the veins; veins reddish brown but becoming more brownish towards the wing-margin; upper branch of the cubital fork with no recurrent veinlet or sometimes with the trace; first posterior cell widely open but sometimes considerably narrowed at the wing-margin; anal cell closed long before the wing-margin; discal cell very large, a little shorter than twice the length of the third posterior cell. Squamae on the alar pair pale greyish black with a brown margin and a short yellowish grey fringe, and on the thoracal pair greyish yellow with a reddish brown

margin and a very short inconspicuous greyish fringe; conspicuous tuft at the lowest part of the alar pair deep orange yellow. Halteres blackish brown with the stalk and the knob paler.

Legs yellowish red, but deep brownish black on the coxae, on the trochanters, and on about the basal two-thirds of the femora; front coxae with an abundant long pubescence which is brownish yellow or orange yellow with the black one intermixed, especially about the tip; front femora covered with a rather dense long (especially on the outer lower surface) black pubescence which is intermixed with similar but yellowish brown pubescence about the apical part especially on the upper surface, and these two kinds of the pubescence are almost all erect or suberect but depressed on the upper margin; front femora beneath for their whole length with a moderately broad bare space slightly channelled at the basal half, for the reception of the folded-back tibiae, and the inner margin of this bare space bearing a dense row of short black bristles; front tibiae clothed with an abundant but not very dense short depressed deep orange yellow pubescence which becomes more short about the intero-lower space, and bearing a very few inconspicuous touch-hairs beneath; middle femora with a pubescence similar to that on the front femora, but the yellowish one is rather fewer; middle tibiae with a rather conspicuous longish suberect brownish yellow or orange yellow pubescence about the upper-outer margin, and with a rather depressed short similarly coloured one on the rest, and bearing two unequal black tipped spurs; hind femora about the lower half furnished with an abundant longer black pubescence intermixed with similar though brownish yellow or orange yellow hairs which occur only about the apical half or sometimes more than that; hind tibiae covered with a dense somewhat long brownish yellow (or orange yellow) fringe on the upper-outer margin, and with a short dense similarly coloured pubescence on the rest, all the tarsi clothed with short depressed brownish yellow or orange yellow bristles; but on the front tarsi beneath there are a very few touch-hairs.

Abdomen large and rather flat, longer than the head and thorax (including the scutellum) together, and broader than the broadest part of the thorax, with the tip roundish. Dorsum deep black, with the rather broad reddish yellow band at the hind margins of the segments, but on the basal segment it is very narrow about the middle one-third; all these bands more or less dusted with ashy grey especially on the basal two or three segments, almost always the grey tomentose space at the middle triangularly notched above; the sides of the segments not reddish yellow but black as in the disc though there are abundant and dense, somewhat outspread golden hairs; pubescence dense and depressed deep golden yellow, and which becomes fewer towards the bases of the segments and which is intermixed with similar but black hairs about the basal two-thirds of each segment, consequently it seems so that there are the conspicuous broad deep golden coloured posterior bands; ventre as on the dorsum except on the first segment entirely black; the three basal bands do not notched above at the middle, and the seventh segment without any long black bristles.

Length: 19-20 mm.

Male unknown to me.

This species is very uncommon in Japan, occuring in the Islands of Sakhalin, Hokkaido, and Formosan. In the latter Island only one female has been collected by Prof. S. Matsumura, at Arisan (about 7600 feet above sealevel), on the first of August in 1907. It is recorded from northern Europe and Siberia, but there is no record from the British Islands. It is quite accessible that *T. tarandinus* occur in Sakhalin and Hokkaido, but it is rather unreasonable to suppose that it is found in Formosa, as it does not occur in the Japanese main islands. The specimen from Formosa is quite identical with the one from Norway, without doubt. The species from Sakhalin is described as *Tabanus karafutonis* by Prof. Matsumura in 1911. It would be impossible for anyone to verify the species from his description in which he makes no mention of the frontal callosities, of the ocelligerous tubercle, and

of the black pubescence on the thorax and abdomen, so characteristic of this species or others in the subgenus *Therioplectes*. From the comparison with *T. tarandinus* from Norway, I could not find even the slightest difference, and I am obliged to determine that *karafutonis* is an undoubtful synonym of the former.

2. Therioplectes hirticeps, Loew (Pl. III, fig. 3; Pl. IX, figs. 9 & 10).

(Komura-Abu).

Tabanus hirticeps, Loew, Wien. Ent. Monatschr., II, p. 105, 1858.
Ricardo, Rec. Ind. Mus., IV, p. 240, 1911.
Kertesz, Cat. Dipt., III, p. 249, 1908.
Tabanus komurae, Matsumura, Joun. Coll. Agr. Tohoku Imp. Univ. Sapporo Japan, IV, 1, p. 65, 1911.

Small though rather broad black species with two shining blackish frontal calli, with a distinct brownish ocelligerous tubercle, with three dorsal ashy grey stripes composed of rather large long-triangular spots, and with white pubescent eyes.

Female. Head very short, slightly broader than the thorax, and slightly arched. Frontal stripe contracted from the vertex to the front eye-angles, four times as long as its broadest part or four and a half times as long as its narrowest part, ashy grey though greyish yellow at a large middle part, except the more or less narrowly furrowed middle stripe shining black; lower frontal callus shining brownish black quadrate (though with roundish angles) about as long as wide, moderately raised forwards, not quite touching the eyes, and hardly continued upwards in a narrow slightly elevated blackish line which represents the upper callus; upper callus about the upper half furcate by a narrow median furrow which reaches just below the ocelligerous tubercle, so as even slightly denuded specimens the frontal callus and ocelligerous tubercle are quite continued; vertex pale yellowish grey, with a distinct though rather small oblong (or sometimes duplicate) shining brown ocelligerous tubercle; pubescence on the frons black, rather abundant

long and erect, but slightly curved below, the pubescence being longer and more or less shaggy on and about the vertical space and almost not occuring below the upper frontal callus; there are four or five long erect black bristly hairs near the eye-margins, although they are often depressed; frontal triangle short and rather broad, ashy grey except on the yellowish double lunule just above the antennae, divided into two lateral ones by a very fine longitudinal surcus which extends from the transverse furrow between the lower frontal callus and the frontal triangle to the upper groove of the face, passing through the very narrow space between the antennal bases, quite bare from pubescence. Face dark yellowish grey, bearing on the cheeks moderately dense somewhat long greyish white pubescence which becomes more denser and longer below, and extends round the lower part of the back of the head, and which becomes shorter above and is intermixed with blackish hairs on the upper part and near the eye-margins; epistoma deeply hollowed in the middle through its length, bearing inconspicuous very short depressed greyish pubescence; side-pits rather large and deep; jowls moderately prominent; and all the lower part of the back of the head slightly inflated; pubescence on the back of the jowls and all about and behind the mouth long somewhat shaggy, mainly greyish yellow; back of the head with a narrow ashy grey bare rim which is only slightly widened on the extreme lower parts and behind the rim lies a short black ciliation which grows longer on the upper part but it does not merge into the lower black pubescence about the vertex. Proboscis dark brownish black, thick and shorter than the depth of the head, bearing a few shorter erect blackish pubescence behind, the pubescence on the sucker-flaps below thinner and rather sparser than that on the stalk; palpi about two-thirds as long as the proboscis, rather slender, greyish yellow with a blackish tinge; first joint somewhat conspicuous, greyish black, clothed with long black bristly hairs which become longer and yellowish grey below; second joint rapidly bent below at the apex of about the basal one-third

and placed against the proboscis, rather broad about the base one-third and gradually diminishing to a point, less than three times as long as the broadest part, clothed with short dense depressed black bristles which are not quite dense enough to obscure the ground colour but bare on the inner side except its apical part at where the bristles more or less occur. Antennae deep reddish yellow, with the basal joint and apical style darker; first joint somewhat dusted with grey and blackish at the outside, bearing dense short black bristly hairs which are however longer and less bristly beneath, and which become much shorter and sparser at the inner side; second joint very short, about one-third as long as the basal one, very inconspicuously produced above, with a circlet of short black bristles about the tip which become denser on both the upper and under sides; third joint reddish with its large basal annulation darkened dorsally about the apical half, and with thick annulated style darkened brownish black; dorsal hump of the basal annulation of the third joint almost just before the middle, moderate, rounded (not angulated), bearing a very few inconspicuous black bristles, depth of the segment at the hump fully two-thirds its length; style slightly shorter than the basal annulation of the third joint, and with an elongate concial apical annulation which is about twice as long as preceding one. Eyes in profile ovate with a large roundish lower margin, about one and a half times as deep as wide, when seen from the front somewhat broader than the depth with roundish inner angles; facets all equal in size, but at the extreme posterior margins somewhat smaller; pubescence greyish yellow, moderately dense on the front part but becoming short sparse and paler on the upper, lower and hind margins; in death somewhat greenish deep black, with three narrow purplish transverse bands similar to those in *tarandinus*, L., but in which the middle one becomes broader outwards and the upper band is almost equal in width through its length and about as wide as the broadest part of the middle band, while the lower one is narrower than the upper band though with same width through its length; upper and lower bands

equidistant from the middle, after the middle these two gradually apart from the middle band and on the hind quarter sharply converging until they each almost touch the middle band.

Thorax rather short and roundish, black slightly dusted with greyish. Dorsum much grey apically, with three inconspicuous greyish median stripes of which the middle one is very narrow and appears about the anterior part, while the others are about twice as wide as the middle line (still narrow) and extends from the anterior margin to the posterior margin sinuated at the suture; the sides of the disc more or less greyish white, so that there are very inconspicuous though broad lateral stripes; pubescence on the disc short, depressed, yellowish, but with abundant somewhat long erect black bristly hairs intermixed all over the surface, the yellowish pubescence growing up much longer just above the wing-bases and on the outer margin of the postalar callus and the black hairs becoming more numerous and longer towards the sides; humeri distinct greyish brown, clothed with long shaggy greyish yellow hairs; scutellum more greyish than the thorax, clothed with scattered long black bristly hairs. Pleurae dark yellowish grey, covered with a numerous long yellowish white pubescence which is intermixed with similar but black hairs, the tuft of long shaggy greyish yellow hairs on the prothorax, and on the upper-hind margins of the meso-, meta- and ptero-pleurae, conspicuous.

Wings about as long as the thorax and abdomen together, somewhat greyish hyaline but brownish towards the costal margin, with the veins at the apical margin of the basal cells, stem and lower branch of the postical fork, and the base of the upper branch of the cubital fork (and sometimes with other veins), more or less brownish, and with the stigma dark brown; the upper branch of the cubital fork with no recurrent veinlet or some trace; first posterior cell widely opened, and somewhat equal in width about the apical half; anal cell closed long before the wing-margin; discal cell moderate in size, slightly longer than second posterior cell. Squamae in the alar

pair grey with a blackish margin and a rather conspicuous fringe of long hairs, in the thoracal pair yellowish glassy with a greyish yellow margin and an inconspicuous sparse fringe of long (about as long as those in the alar pair) though very thin pale yellowish hairs; hair tuft about the angle of the alar pair conspicuous and yellow. Halteres blackish, with stalk and tip of the knob paler.

Legs black but slightly dusted with grey, and the extreme tips of all the femora more or less brown, and all the tibiae obscurely dark red-brownish black with the basal parts of two anterior tibiae slightly but distinctly paler; front coxae densely covered with a yellowish grey tomentum, and clothed with a long black pubescence which is intermixed with similar but longer yellowish grey hairs about the base, and which becomes shorter and rather sparser at the tip; front femora clothed with an erect dark castaneous pubescence which becomes shorter on the upper and inner sides, and which disappears on the shining lower side, this bare space being broad but not hollowed about the basal two-thirds though very finely striolate, and the row of tiny bristles on its inner margin moderately long; front tibiae densely clothed with a short depressed black pubescence which becomes slightly longer outwards and much shorter inwards, and bearing a very few inconspicuous touch-hairs beneath; middle femora covered with a black pubescence which grows up very longer beneath and becomes very short above; middle tibiae bearing a numerous moderately dense short black pubescence all over, and with a fringe of a few long blackish hairs on the upper-outer margin and with two rather slender unequal blackish spurs; pubescence on the hind femora similar to those on the middle femora but somewhat more numerous and longer; hind tibiae with a rather coarse and rather dense dorsal ciliation, and with a more dense though less coarse and short ciliation beneath; there are some rather distinct touch-hairs beneath the basal joint of the front tarsi and at the tips of the next three joints; all the tarsi furnished with short, dense, depressed, reddish golden or orange

yellow bristles beneath ; all the femora about the base with a whitish yellow pubescence (especially on the under side) which usually merges into the black one and which sometimes disappears, and on the posterior tibiae there is a few paler pubescence about the base, though sometimes disappeared ; apical joint of all the tarsi bearing a fringe of somewhat long blackish bristly hairs about the upper apical margin. Pulvilli dull orange yellow ; claws obscurely brownished red at the base but black at the tip.

Abdomen broader than the thorax, and very slightly longer than the head and thorax (including the scutellum) together, flattened and the tip not pointed but roundly convex, black. Dorsum moderately shining but slightly dusted with brownish, the posterior margin of each segment very narrowly but distinctly tinged with yellow but obscured by a dense ashy grey tomentum, with three interrupted ashy grey dorsal stripes composed of triangular spots, which are usually inconspicuous on the apical three segment and can easily denude especially on the posterior segments ; these spots not continued with the preceding spot or following one, but the three spots on the same segment connected with each other by a narrow ashy grey hind marginal band ; the sides very narrowly tinged with yellowish brown, but not covered with a ashy grey dust ; pubescence on the disc sloping, rather numerous and black, but on the ashy grey spots and on the same coloured posterior marginal bands mostly greyish white ; on the sides there are rather numerous outspread black hairs, which about the insides of the lateral margins are intermixed with a rather conspicuous yellowish white pubescence, especially on the second and third segments. Ventre black, moderately dusted with grey, with narrow yellowish grey hind marginal bands except on the basal segment clothed with fine sloping yellowish pubescence with longer less sloping black bristly hairs intermixed ; the black hairs become more conspicuous towards the tip, and on the seventh segment much more bristly and almost erect.

Length : 11.8-12.1 mm.

Loew's description fits with two females from Sakhalin and Hokkaido, so well that I am induced to refer them to this species. The specimen from Sakhalin is *Tabanus komurae*, Matsumura, without any doubt, from the comparison with his type. He described from rather a denuded specimen, and his description is not accessible for determication of this species. I am obliged to abandon the name, *komurae* established by him. *Therioplectes hirticeps* is not very common even in the two Islands of Hokkaido and Sakhalin, as I have records only from Solowiyofka and Jozankei, from July 12th to 16th. The female is one of horse-biters, but her attack may not be so severe as that of the following species.

3. **Therioplectes tropicus**, Panz. (Pl. III, figs. 4 & 5).

(Kiboshi-Abu, or Karafuto-Kuro-Abu.)

Tabanus tropicus, Panz., Fauna Germ., XIII, Pl. XXII, 1794.

Meigen, Klass., I., p. 168, 1804; Syst. Beschr., II, p. 57, 1820.

Linne, Fauna Suec., p. 463, 1761 (pt.); Syst. Nat., ed. XII,2, p. 1001, 1767 (pt.).

Mueller, Zool. Dan. Prodr., p. 180, 1776 (pt.); Fauna Ins. Fridr. p. 86, 1764 (pt.).

Scop., Ent. Carn., p. 371, 1763 (pt.).

Deg., Mem. pour serv. a l'hist. d. Ins., VI, p. 220, pl. XII, fig. 15, 1776 (pt.).

Fabricius, Spec. Ins., II, p. 458, 1781 (pt.).; Syst. Antliat., p. 100, 1805 (pt.); Ent. Syst., IV, p. 368, 1894 (pt.).

Schranck, Enum. Ins. Austr., p. 479, 1781 (pt.); Fauna Boica, III, p. 154, 1803 (pt.).

Herbst, Gem. Naturgesch., VIII, p. 113, pl. CCCXLII, fig. 4, 1787 (pt.).

Vill., Entom. Linn., III, p. 553, 1789 (pt.)

Gmel., Syst. Nat., V. p. 2884, 1792 (pt.).

Schellenb. Gutt. Flieg., p. 72, pl. XXVII, fig. 2, 1803 (pt.).
Latr., Gen. Crust. et Ins., IV, p. 283, 1809 (pt.).
Fallen, Kongl. Vet. Akad. Handl,, XXX, p. 240, 1809 (pt.); Dipt. Suec., Tab., p. 5, 1817 (pt.).
Macquart, Recuell Soc. Sci. Agr. Lille, p. 481, 1826 (pt.); Suit. A Buffon, I, p. 202, 1834 (pt.).
Duncan, Mag. Zool. & Botan., I, p. 367, 1837 (pt.).
Zetterstedt, Ins. Lapp., Dipt., p. 514, 1838 (pt.); Dipt. Scand., I, p. III, 1842 (pt.); Dipt. Scand., VIII, p. 2937, 1849 (pt.); Dipt. Scand., XII, p. 4548, 1855 (pt.).
Gemm., Bull. Soc. Imp. Nat. Moscou, XX, I, p. 185, 1847 (pt.).
Walker, List. Dipt. Brit. Mus., I, p. 169, 1848 (pt.); Insecta Brit. Dipt., I, p. 39, 1851 (pt.); List Dipt. Brit. Mus., V. Suppl., I, pp. 156 & 168, 1854 (pt.).
L. Duf., Mem. Acad. Sc., Math. et Phys., XI, p. 171, pl. IV, fig. 77, 1850 (pt.).
Scholtz, Zeitschr. Ent. Breslau, IV, 16, p. 37, 1850 (pt.).
Bonsd., Finlands tvaving. Ins., I, p. 108, 1861 (pt.).
Jaenn., Berlin. Ent. Zeitschr., X, p. 70, 1866, (pt.).
Fedtsch., Acta Soc. Am. Nat. Moscou, VI, p. 62, 1868 (pt.).
Pand., Revue d'Entom., II, p. 213, 1883.
Girschn., Berlin. Ent. Zeitschr., XXXI, pl. III, fig. 1, 1887.
Coucke, Ann. Soc. Entom. Belgique. XXXVI, p. 138, 1892.
Villeneuve, Ann. Soc. Ent. France, LXXIV, p. 306, 1905.
Kertesz, Cat. Dipt., III, p. 288, 1908.

Therioplectes tropicus, Gob., Mem. Soc. Linn. Nord France, p. 14,1881.
Becker, Berlin. Ent. Zeitshr., XXXI, p. 106, 1887.
Verrall Brit. Dipt., V, p. 355, 1909.
Zell., Isis, XI, p. 822, 1842 (pt.).

Tabanus paganus, Fabricius, Spec. Insect., II, p. 458, 1781; Entom. Syst., IV, p. 367, 1794; Syst. Antliat, p. 99, 1805.
Vill., Entom. Linn., III, p. 559, 1789.

Gmel., Syst. Nat., V, p. 2883, 1792.

Meigen, Klass., I, p. 173, 1804 ; Syst. Beschr., II, pp. 63 & 64, 1820.

Kertesz, Cat. Dipt., III, p. 263, 1908.

Tabanus luridus, Loew, Verh. Zool.-Bot. Ges. Wien, VIII, p. 526, 1858 (pt.).

Schiner, Fauna Austriaca, Dipt., I, p. 31, 1862.

Verrall, Brit. Dipt., V, p. 360, 1909.

Tabanus signatus Schiner, Fauna Austr., Dipt., I, p. 29, 1862 (pt.).

Verrall, Brit. Dipt., V, p. 360, 1909.

Tabanus borealis Jaenn., Berlin. Entom. Zeitschr., X, p. 69, 1866.

Kertesz, Cat. Dipt., III, p. 289, 1908.

Verrall, Brit. Dipt., V, p. 360, 1909.

? *Tabanus bimaculatus*, Macquart, Recuil Soc. Sc. Agr. Lille, p. 484, 1826.

Meigen, Syst. Beschr., VII, p. 59, 1838.

Walker, List Dipt. Brit. Mus., V, Suppl. I, pp. 157 & 170, 1854.

Gob., Mem. Soc. Linn. Nord France, p, 27, 1881.

Kertesz, Cat. Dipt., III, p. 288, 1908.

Verrall, Brit. Dipt., V. p. 360, 1909.

Tabanus luridus Matsumura, Journ. Coll. Agr. Tohoku Imp. Univ., Sapporo, Japan, IV, 1, p. 64, 1911.

Tadanus sachalinensis Matsumura, Journ. Coll. Agr. Tohoku Imp. Univ., Sapporo, Japan, IV, 1, p. 65, 1911.

A rather medium-sized species with the abdomen not conspicuously orange red, with a tuft of black hairs on the vertex behind the ocelli, and with the middle tibiae conspicuously pubescent.

Female. Head very slightly broader than or about as wide as the thorax, short, about one-third as long as its width, slightly arched. Frontal stripe gradually but slightly diminishing in width from the vertex to the frontal triangle as it is almost parallel-sided, and about three and a half times (or four times) as long as its broadest part or about four times (or five and a half times) as long as its narrowest part, ashy

grey to light brownish grey, but with a blackish sheen down the middle; lower frontal callus shining black, almost quadrate, rather transverse and almost always not quite touching the eyes, and almost always not continued to an elongate narrow black upper frontal callus which is not conspicuously elevated; vertex indistinctly darkened round the ocellar space; ocelligerous tubercle only slightly raised but distinctly shining brownish red, ovate; pubescence on the frons abundant and black, normally sloping forwards, and distinctly longer on and about the vertical space but yellowish above the lower callus; frontal triangle moderately broad, separated by a conspicuous furrow from the cheeks and divided into two lateral parts by a very fine though distinct longitudinal middle furrow which extends from the lower frontal callus to the space between the dusty orange antennal pits, with apparently a blackish ground colour but obscured by a dense light grey or yellowish grey tomentum, and without any pubescence. Face moderately elevated, light grey or yellowish grey, but gradually paled below; cheeks moderate in size and moderately puffed out below the eyes, bearing long yellowish grey pubescence which grows conspicuously longer on the jowls, and which is intermixed with blackish hairs on about the upper three-fourths, and the greyish pubescence not extending so far as its extreme upper part; pubescence on the broad distinctly raised-up epistoma rather longer, pale and sparse all over, intermixed with very few long somewhat bristly black hairs about the middle part or the upper side; pubescence on the lower part of the jowls and all about the mouth yellowish white; back of the eyes with a distinct equal narrow bare light grey rim, and behind this rim lies a short brownish yellow ciliation which becomes longer and rather less blackish on the upper half but which does not merge into the longer black pubescence about the vertex. Proboscis brownish black, thick, about two-thirds as long as the depth of the head, with short yellowish pubescence behind the stalk and with similar but rather longer and sparser one on the lower surface of the large sucker-flaps. Palpi slightly shorter than the proboscis, and

rather slender; first joint very short, globular, yellow but with outer surface almost entirely darkened, and bearing long pale pubescence though sometimes with some still longer pale hairs similar to those on the lower jowls beneath about the tip; second joint pale yellow or dull yellow, rarely orange, with numerous short black bristles which are often absent the base and which are not at all obscuring the ground colour but bare on the inner side and beneath at the base; this moderately curved second joint moderately dilated soon after its base and then gradually tapering to a rather blunt point, and more than three times as long as its broadest part. Antennae greyish black with the base of the third joint more or less reddish; basal very slightly dilated towards the apex at where the upper margin is distinctly (though slightly) produced forwards, dusted with yellowish grey, bearing comparatively short rather dense pubescence which is black above especially on the produced part but partly pale beneath, this pubescence being distinctly longer than black one; second joint very small a little longer than (or as long as) one-third the length of the basal joint with a short narrow produced angle at the upper apical margin, sometimes with a slight reddish tinge, and with a somewhat incomplete fringe of short black bristles with are very short on the upper side but rather longer on the under side; third joint about two and a half times as long as the precedings together, with about the basal half of its large first annulation reddish, and often brownish red on the rest of that annulation which bears a moderate but well-formed dorsal hump (bearing minute black bristles) near the base, and the annulation at the hump fully two-thirds its length; the style deep black, shorter than the basal annulation of the third joint, with the slender apical annulation which is about as long as two preceding ones together. Eyes with the facets all nearly equal in size, clothed with somewhat long brownish pubescence on the front part, but the pubescence not extending to the upper or hind part and becoming short, sparse and pale on the lower part, when seen from the side ovate, about one and a half times as

deep as wide, and when seen from the front about as wide as deep; eyes in death slightly greenish or purplish deep black, with three narrow but entire or not entire purplish transverse bands (narrower than those in the former species), of which the middle band runs straight from the top of the frontal triangle to the middle of the back of the eye, while the upper and lower bands are rather broad, equidistant from the middle one but very inconspicuously divergent outwards and on the outer quarter sharply converging until they almost touch the middle line, these three bands sometimes not quite sharply defined or not quite conspicuous at the hind end.

Thorax black, moderately dusted with grey or brownish grey, and moderately shining, short and stout, somewhat roundish, with three rather indistinct grey or brownish grey median stripes of which the middle one is very narrow and more inconspicuous and does not reach the posterior margin, while the others are broader, rather distinct, extending from the front part to the hind margin, and are slightly approached from one another after the suture and indistinctly fused together leaving a faint blackish triangle at the middle of the hind border, there is other stripe on the side of the disc, which is very broad though not well-defined and tends to connect with the outer median stripe on the front part and about the suture; these stripes are light yellowish grey or somewhat ashy grey; pubescence on the disc mostly long and erect, black, but on the greyish stripes there is an abundant thin, short and despressed, yellowish white pubescence which grows up considerably longer and tuft-like above the wing-bases; humeri sometimes brownish grey, clothed with long somewhat shaggy yellowish white hairs; praealar calli somewhat indistinct greyish black or sometimes greyish red-brown, with a distinct tuft of long shaggy black hairs and with a few shorter yellowish pubescence intersparsed above; postalar calli slightly brownish yellow or sometimes greyish red-brown, covered with rather sparse long black hairs above but about the lower half with rather dense long yellowish hairs similar to those above the

wing-bases; scutellum almost all with scattered long black pubescence but at the margin there are rather dense long yellowish hairs. Pleurae dusted with ashy grey, with mainly long pale yellowish grey pubescence, with blackish grey hairs intermixed but not dense on the disc of the mesopleurae, though the extreme back part bears a conspicuous dense pale tuft, and on the prothorax and on the upper back of the metapleurae there are similar dense pale tufts.

Legs black but dusted with grey, and the extreme tips of all the femora dull reddish orange, and all the tibiae obscurely reddish orange except that the front tibiae are blackish all down the underside and obscurely blackish on all the apical quarter or even half, while rarely just the tips of the posterior tibiae are also blackish; front coxae ashy grey and bearing long yellowish grey pubescence but shorter and blackish about the tip; pubescence on the front femora black about the outside but towards the base outer-dorsally longer, less dense, and grey, while the bare subfemoral space is broad dull black and is slightly (though almost entirely through the length) channelled for the reception of the folded back tibiae, and the anterior margin of this rather distinctly striolate bare space bearing a dense row of short black bristles; that on the middle femora black and not dense interventrally, but dense and yellowish grey outwards, and on the hind femora longer and abundant beneath and mixed black and grey, though a shorter almost adherent pubescence is conspicuously pale all about the tip except on the under surface; front tibiae clothed with rather short and despressed black and yellowish grey bristle hairs, and bearing a few rather short touch-hairs; middle tibiae covered with long conspicuous delicate hardly dense yellowish pubescence all over except at the base where rather short one occurs, this yellowish pubescence with a few rather stout black bristly hairs intermixed especially at the tip where the pale one almost entirely absent; hind tibiae bearing a coarse dense rather sloping dorsal ciliation, and covering with short yellowish pubescence all over, without any conspicuous ventral ciliation;

the spurs of the middle tibiae brownish red with a black tip, and unequal in length; the front tarsi bearing a few scattered rather short though conspicuous touch-hairs beneath the basal joint and at the tips of the following three joints; and the posterior tarsi with reddish soles but on the hind tarsi slightly obscured. Pulvilli brownish yellow; claws dark brown at the base but black at the tip.

Wings slightly greyish or brownish, but brownish yellow or pale brownish at the base up to the basal cross-veins; costal cell yellow or brownish yellow; subcostal vein strong, dark brown, widening about its tip and with brownish orange or blackish brown marginal clouding there which forms a long narrow indefinite stigma, this clouding sometimes extending below to the stalk of the cubital fork; anal cell closed long before the margin, and sometimes pale yellowish on account of the yellowish clouded postical vein; upper branch of the cubital fork very rarely with a short recurrent veinlet; first posterior cell widely open, but almost always slightly contracting towards the wing-margin; all the veins dark brown but mediastinal vein, radial vein and postical vein usually paler. Squamae in the alar pair smoky glassy grey with a narrow blackish margin and with a minute and pale fringe, but with the usual rather conspicuous whitish yellow tuft of longer hairs at its lower angle; in the thoracal pair rather yellowish, with a rather broad light brownish orange margin and with a shorter but rather denser pale fringe. Halteres dark blackish brown, with the apex of the knob slightly yellowish.

Abdomen broad and rather ovate, slightly longer than twice the thorax (not including the scutellum), and apparently wider than the broadest part of the thorax, greyish black. Dorsum moderately shining, with the hind corners of the first segment extending considerably along the hind margin and the front corners of the second segment extending out considerably on to the disc, rather obscurely brownish red to yellowish brown; this colour however varies considerably in extent, as it is sometimes inconspicuous, while it may occasionally be broad and

conspicuous at the sides of the two basal and on most of the third segments, or there may be only two small brownish red spots on the third segment in addition to the brownish red sides of the two basal segments, or in all these cases the two basal segments almost always have brownish black extreme sides which sometimes are very inconspicuous on the second segment; pubescence (and tomentum) forming rather conspicuous yellowish grey triangles, diminishing behind in size, on the middle of the second to fifth hindmargins and extending almost to the foremargins at their points, and the yellowish grey pubescence about the hind corners of the second segment and about the sides of the third to fifth segments almost forming the usual rows of greyish lateral flecks so frequent in the *Tabanidae*, and to confirm this there are (when seen from behind) faint indications of a middle and two lateral rows of rather large brownish spots, while on each side of the middle triangles of yellowish grey pubescence and on the outside of the greyish lateral triangles the abdomen bears similar but black pubescence and is consequently blackish; hind margins of the second to seventh segments very narrowly pale ferrugineous and bearing rather few yellowish hindmarginal fringes; side-margins of the third to seventh segments rather conspicuously and somewhat broadly pale ferrugineous, and bearing mainly pale sidemarginal pubescence which sometimes includes a few black hairs on the two or three basal segments. Ventre greyer than the dorsum, usually with two lateral reddish brown or yellowish brown flecks which extend from the disc of the second segment to the hindmargin of the third segment; these reddish spots sometimes are large as they extend to the side-margin and hardly connect with one another leaving an inconspicuous blackish spot in the middle of each segment, or entirely connect leaving no intermediate blackish dots, while in one case the ventre is entirely greyish black; the hindmargins of the segments (excepting of the first segment) narrowly yellowish grey in any cases but with no obvious fringes; pubescence short depressed and pale, though a few

inconspicuous black hairs occur about the middle of each segment (excepting for the basal segment) which are more noticeable on the two or three terminal segments.

Length: 15-16 mm.

Male. Darker than the female, and usually with brownish red lateral markings extending over the four basal segments on the angularly ended abdomen. Head rather small, narrower than the thorax. Frons quite bare, in profile slightly produced to an antennal prominence, triangle, the apex being produced into a long point between the eyes, covered with whitish or dull yellowish (this is only obvious when seen from above) dust though its sharp upper point may be obscurely darkened, and with a narrow middle furrow as in the female; face in profile not produced at all beyond the eyes, but slightly produced at the front part of the jowls, with frons forming a triangle of which the base rather longer than the sides, dusted with dull yellow or greyish though inconspicuous rather dark bands may extend from the eyes to the lower part of the antennal fossae, covered with rather long abundant pubescence, which is black on all the cheeks and which extends below the jowls but very little beneath the eyes so that it reaches (as long pubescence) only about half-way under the eyes towards the back of the head; on all the epistoma the long pubescence is dull pale yellow and rather sparse; jowls moderate in size, almost always covered with a dull yellow dust, and on its back and all about the mouth there are long dull pale yellow pubescence similar to that on the epistoma; back of the head covered with a dull yellow tomentum, the lower half only just inflated but the upper part is hollowed back from the eyes and leaves only a submarginal rim which bears on its hind margin extremely short black ciliation until above the middle of the head, after which the pubescence becomes slightly longer and is pale, while well before the top it becomes distinctly longer (though still not conspicuously long) and forms a pale fringe up to the vertex, and there is an obvious tuft of forwards-curved black hairs just behind

the ocelligerous tubercle; vertical space very small, dark chestnut, slightly but distinctly elevated. Proboscis rather darker apparently shorter than that in the female, and bearing much numerous pubescence. Palpi much darker, very short, a littie longer than half the length of the proboscis; basal joint very small, globular, bearing long and very nearly all dull yellowish pubescence; second joint elongate ovate, hardly twice as long as broad, and hardly wider at the middle than at the base, and ending in a rather blunt tip, dull yellowish, and with rather long almost entirely black hairs on the outside but almost bare and yellower on the inside, and on the upper part about the base there are longer pubescence almost all dull yellowish. Antennae almost as in the female, but rather much darkened and with rather longer stouter hairs. Eyes touching for a very long space more than middle one-third of the frontal part, and densely clothed with brownish grey or (in some lights) light grey pubescence; facets on the prominent front part are rather larger than the others though but very slightly so when compared with those about the part where the eyes touch, but when viewed sideways the facets for a large space on the lower part are very obviously smaller than those about the middle and the front part, but all changes in size of the facets are gradual; in death deep brownish black with three purplish bands, which are similar to those in the female but the upper band very short as only extending from the frontal margin to about the middle of the eye, and the middle one is not straight being parallel to the lower band.

Thorax brownish black, moderately shining, and with the large praealar calli obscurely chestnut, and with more faint stripes; pubeseence on the disc dense, erect, and black, but scattered in and out amongst it are some thin light grey hairs which are only about half as long as the black hairs and which are very inconspicuous except on the extreme front part where no long black hairs occur and sometimes on the sides of the disc; pleurae usually almost entirely clothed with long dense hairs but with a few pale hairs on the upper hind

part, and the rest of the pleurae bears dense long shaggy pale brownish yellow pubescence; scutellum as in the female but there is a very few pale pubescence mainly greyish along the dorso-pleural suture and sometimes on the upper part of the mesopleurae and under the front part of the wing-base where there is a tuft, while there is a dense conspicuous whitish or yellowish white tuft on the prothorax and a very large tuft on the metapleurae.

Wings and halteres as in the female, but the disc of the squamae rather deeper coloured.

Legs as in the female, but less greyish and all the pubescence much conspicuous, darker, and longer, and with the long but delicate inner-ventral ciliation.

Abdomen rather short and narrow, slightly longer than the thorax (including the scutellum) and head together, gradually narrowed towards the pointed apex. Dorsum rather deep black with the large brownish orange lateral markings occupying most of the three basal segments leaving the broad black dorsal stripe; this black dorsal stripe extending all across the base of the basal segment but narrowing down to more than the middle third of the hind-margin, and on the second segment formiug a large transverse quadrate spot occupying about the middle third of the segment, and the middle part of this black space rather greyish or greyish yellow while the spot itself may widen somewhat near the hindmargin but usually contracts at the hindmargin itself; the black stripe on the third segment is similar to that on the second segment but narrower; on the fourth segment there is a short brownish orange spot at the sides of the foremargin which is continued to the above lateral marking; there is an obscure dark lateral line at the side of the second and third segments; the actual sidemargins are very narrowly brownish red, and the hindmargins of the second to sixth segments and the extreme hind corners of the first segment bear a fairly conspicuous yellow fringe, which may be widen into shallow triangles about the middle of the second and third hindmargins (or sometimes

on the fourth segment); the three (or sometimes four) terminal segments are black, but the fifth and sixth are slightly and obscurely reddish at just the sides; pubescence on the dorsum usually black, somewhat dense and outstanding at the sides, and fairly equal all down the sides, but sometimes on the disc with pale hairs on the second, third, and fourth segments just where pale grey flecks occur as in other species. Ventre somewhat paler, being more brownish orange near to the end of the fourth segment, but the basal segment obscurely blackish on at least the middle part, and the second segment with a rather large though not well-defined middle black spot; the three terminal segments blackish; the hind margins of the segments with a narrow but rather conspicuous band and fringe which is most conspicuous about the middle of each hindmargin; the remaining pubescence all black and short, but on the apical segments rather long and conspicuous, while pale hairs occur on the disc and occasionally almost exclusively. Genitalia reddish brown, two-jointed, large, brownish orange, or which the first joint is almost quadrate, the second joint is somewhat triangular, blackish, nearly as broad as long, and bears black hairs on the sides but has a fringe of incurved pale hairs at the end.

Length: 14-15 mm.

This species varies in some few respects in Japanese specimens, and there is no form of *bisignatus*, but this requires much care in identification. However, *T. tropicus* may be distinguished from *T. montanus*, by the presence in both sexes of the conspicuous tuft of long black hairs on the upper of the vertex, by the long pubescence on the basal joint of the antennae, by the much more pubescent middle tibiae, by the large size, and in the female by the conspicuous black pubescence on the frontal stripe of the head; from *T. distinguendus* and *T. solstitialis* by the absence of the conspicuous bright orange abdominal marking, and in both sexes by the three distinct eye-bands; from *T. luridus*, in both sexes, by the normally

larger size, and in the female by no sign of shining black frontal triangle. *T. tropicus* from Japan almost always has rather a broad (not very contracted from tip to bottom) frontal stripe which bears generally two quite separated frontal calli and is of medium size. In fact, one may sometimes say, that our form belongs to the intermediate one between *tropicus* and *montanus* from Europe, but I do not hesitate to determine it as a form of the former.

A female type under the name *Tabanus sakhalinensis* in Matsumura's collection from Todoroki, Sakhalin Island, is quite identical with some of the British forms of *tropicus* and is not a distinct species.

These flies occur only in the northern part of Japan, Hokkaido (Honshu) and Sakhalin Islands, and in the latter Island it is rather common, while in the former it is probably not very abundant. I noticed that it attacks the belly of horses or cattle in Hokkaido, but I have no other records from an economic point of view. I have records from Kioto, Tokio, Rikubetsu, Josankei, Sapporo, Galkino, Shisuka, Solowiyofka, Shimizu, Ushoro, and Galkinowraske, from June 20th to August 8th.

4. Therioplectes distinguendus, Verrall. (Pl. III, figs. 6 & 7.

(Kibar.-Abu).

Brit. Flies, V, p. 371, fig. 230, 1909.

Tabanus tropicus Matsumura, Thous. Ins. Japan, II, p. 73, pl. XXII, fig. 6, 1905.

A rather large species with the abdomen very extensively bright brownish orange except for the narrow black dorsal stripe and tip; closely allied to the preceding species.

Female. Head very slightly longer than or about as long as the thorax, about one-third as long as its width, slightly arched. Frontal stripe slightly narrowed below to the front eye-angles, and nearly four times as long as its widest part or about five and a half

times as long as its narrowest part, greyish yellow above but becoming brownish orange about the middle and more yellowish just above the lower frontal callus; lower frontal callus shining black, almost quadrate or even lighter than broad, slightly elevated, and not touching the eyes at any part, or sometimes touching the eye-angles and connected with long narrow shining black upper frontal callus by a narrow somewhat raised black line, the intermediate line between the lower and upper frontal calli almost always dusted with greyish yellow; ocelligerous tubercle roundish, shining dark chestnut, more raised than the upper frontal callus; vertex blackish grey, and frontal triangle ashy grey but slightly yellowish about the middle, with the yellowish double lunule just above the antennal pits and with a usual middle fine furrow, quite bare from pubescence; pubescence on the frontal stripe rather dense, rather short, mixed black and yellow; the yellow hairs being rather thinner but rather conspicuous, and usually the black ones sloping forwards about the lower half or erect about the upper half; pubescence on the vertex rather longer, curved forwards, and all black except for sometimes a very few pale hairs close against the occiput. Face yellowish ashy grey, moderately elevated from the eyes; cheeks rather broad, very slightly narrow above where the oblique furrow appears and the face separated from that by it, with mainly pale yellow silky hairs, which are intermixed with a few short blackish hairs on the upper part, and which grow longer and shaggy on the jowls; epistoma almost always more yellowish, with scattered yellowish silky pubescence which is intermixed with a few rather stout but inconspicuous black hairs about the middle; pubescence on the lower part of the jowls and all about the back of the mouth longer and pale yellowish, dense and conspicuous; all along below the eyes and up all the back of the head to the vertex is a narrow dull pale yellowish grey bare rim, behind which is a rather short though rather crowded ciliation of brownish yellow hairs which only extend to the upper eye-angle; back of the head all light grey and bearing on the back of the jowls some

long pale hairs. Proboscis dull black, about two-thirds as long as the depth of the head, on the stalk there are numerous conspicuous rather pale hairs, and beneath the sucker-flaps rather few shorter ones. Palpi pale dull luteous to dull orange, shorter than the proboscis; first joint blackish grey but covered with a greyish yellow tomentum, and bearing long pale hairs, with two or three black hairs intermixed on the outer corner near the apex; second joint long, hardly four times as long as the broadest part, broad from the base up to about the middle, after which they droop and gradually diminish to a moderate point, clothed with the short dense depressed black bristles which are intermixed with some less distinct thinner shorter pale yellow pubescence on the upper basal part, and which sometimes become sparse about the basal one-thirds and in that case the numerous pale bristles occur there. Antennae about as long as the palpi, blackish; basal joint slightly extending rather cap-like over the small second joint, blackish orange obscured by a yellowish grey tomentum, bearing numerous long thin pale hairs, most obvious about the underside, and with short black bristles intermixed above on the apical half; second joint short, about one-third as long as the first joint not produced above, reddish brown, very slightly dusted with greyish, bearing a circlet of short black bristles around the apex which are rather conspicuous on the under- and upper-sides, on the underside there is a few pale longer pubescence; third joint yellowish red but darkened after the hump, with the large basal annulation sometimes all reddish or sometimes nearly all darkened, and with the rather narrow style which is shorter than the basal annulation and has a elongated conical apical annulation; the dorsal hump near the base distinct and bearing tiny black bristles, the depth of the annulation at the hump being fully two-thirds its length. Eyes in shape as in the preceding species, clothed with short dense dark brownish pubescence which becomes very sparse or even absent on and near the hind and lower margins, and which in some light appears paler on the lower half; eyes in death deep purplish black with slight

greenish ruster, and bearing three deep reddish purple bands, of which the middle bands is narrowest and is straight but its outer part slightly runs upwards, and which does not reach the hindmargin, while the upper and lower bands are almost equidistant from the middle one and somewhat approach each other at the back after the middle band has ceased.

Thorax greyish or brownish black, slightly shining, with three greyish brown stripes of which the middle one is rather narrow and the side ones wider but only distinct in front and just below the suture, while on the broadest front part they have a tendency to curve over to the vague grey side stripes which extend back to the wing-base, and the grey part just below the suture has a tendency to unite with other vague grey stripes which lie about half-way between them and wing-bases, and which are never connected with the inner side stripes at even the posterior ends but fused with the much vague lateral grey stripes on the postalar calli, the three middle stripes more or less being united together at the posterior part but not so distinct as in *tropicus*; humeri pale ashy grey or pale reddish grey, bearing rather numerous but rather shaggy short (still long) pubescence; praealar calli distinct, pale ferrugineous or greyish black but in any cases with a faint trace of ferrugineous colouring; postalar calli somewhat pale, sometimes slightly rose-reddish antero-posterior margin; scutellum coloured as in the thorax, bearing the long erect black and yellowish hairs. Pubescence on the disc of the thorax short, somewhat dense, black, which does not extend quite to the front part where the hollowed out head fits on, but intermixed with this are scattered rather sparse very depressed thin yellowish hairs which become dense and more erect on the front part where there are no black hairs, and there are conspicuous long more erect yellowish hairs about the side-margins, and also there are conspicuous sloping greyish yellow tuft just above the wing-bases and at the lower part of the postalar calli. Pleurae slightly greyish black, bearing long shaggy pale brownish yellow or

greyish yellow pubescence which is intermixed with long somewhat conspicuous black hairs about the upper half of the mesopleurae and there is a distinct yellowish brown tuft on its posterior margin; on the prothorax and metapleurae there is conspicuous though less than that on the mesopleurae long greyish yellow tuft.

Wings somewhat greyish, with a distinct yellowish brown tinge at the base and the foremargin above the subcostal vein, and also the sides of the stem of the postical vein tinged with yellowish brown; stigma composed of only the dark thickened end of the subcostal vein, below the stigma moderately yellowish brown to the radial vein but the base of the marginal cell quite clear; mediastinal vein, basal half of the radial vein, and stem of the postical vein rather brownish yellow; upper branch of the cubital fork sometimes with a short recurrent veinlet; first posterior cell widely open, but sometimes slightly contracted at the margin; anal cell closed long before the margin; discal cell moderate in size, usually conspicuously longer than the second posterior cell. Squamae in the alar pair glassy grey with blackish margin and short sloping greyish yellow fringe, in the thoracal pair glassy yellow with brownish yellow margin and fine erect rather inconspicuous pale yellowish fringe, at the lower angle of the alar pair there is conspicuous dull yellow tuft. Halteres dark brown, with the apex yellowish.

Legs black, but the extreme tip of the femora and almost all the tibiae brownish red or brownish yellow; front coxae greyish black with the extreme tip blackish, clothed with long pale yellowish white silky hairs which become short and rather sparse at the apical part where the short black pubescence occurs; front femora slightly dusted with greyish, with an abundant short black pubuscence which becomes longer at the outside, and with the rather sparse ciliation of tiny black bristles at the inner margin of the bare subfemoral space which is rather distinct, broad and slightly hollowed throughout the whole length; front tibiae growing blackish about the apical half, clothed with tiny black and pale yellow bristles in which the yellow ones almost all occur on the

basal two-fifth, and there is an inconspicuous short ciliation at the outer-upper margin, and also there are a few scattered touch-hairs beneath; middle femora more dusted with greyish than the front pair, bearing sloping rather long somewhat silky yellowish white hairs at the outside, but short much depressed black bristly hairs at the inner and upper sides, and there are a few rather erect long black hairs beneath; middle tibiae darkened about the extreme tip, bearing rather short sparse rather inconspicuous mainly pale yellowish dorsal pubescence (though a few scattered black hairs intermixed), and a slight short pale yellow ciliation on the underside, and the apical quarter bearing only shorter black bristly hairs, and there are unequal black-tipped spurs at the tip of the underside; hind femora with abundant long pale yellowish pubescence beneath and with a little shorter similar but rather sparser pubescence above, all the pubescence becoming shorter towards the tip where a few short blackish hairs occur; hind tibiae darkened at the tip, with short pale pubescence on the basal three-fifth, and with the conspicuous strong somewhat coarse, black ciliation which becomes pale yellowish about the basal half (though there is a few black pubescence), and on the underside with rather inconspicuous very short pale yellowish pubescence which is intermixed with a few similar but black hairs at the apical part; tarsi blackish but paler on the posterior ones, the front tarsi bearing a few silky touch-hairs beneath, and the hind tarsi being reddish orange beneath.

Abdomen longer than the head and thorax (including the scutellum) together, slightly broader than the thorax, slightly narrowed behind though it is rather quadrate, with roundish apex. Dorsum pale brownish orange with rather narrow somewhat interrupted blackish dorsal stripe and dull black tip; basal segment black at the base but with the black colour narrowing to about one-third of the hindmargin and with the extreme sides black; second segment with the middle fourth or less blackish but not quite to the hindmargin; third segment with the midde fifth or much less blackish but also hardly to the

hindmargin and with the sides of the blackish parts on the second and third segments slightly brownish; fourth segment with the middle quarter or more black and with its sides inconspicuously darkened, and usually the intermediate space somewhat darker brownish orange; the following segments dull black, but sometimes the fifth segment with two inconspicuous small dark brownish orange lateral spots near the anterior margin; these black middle markings are not well defined and become vague on the hind half through the great extent of the rather vague triangles of pale yellow pubescence, these yellowish triangles appearing on the second to fourth segments and becoming smaller and more inconspicuous one after other, and resting on a slightly grey piece of ground colour and extending more than half-way up the segment; the second and third segments very slightly brownish at the extreme sides; on the four basal segments there are short dense depressed orange pubescence except on the black and brownish dorsal parts, while the hindmargins of all seven segments have pale orange fringes, and there is a small amount of scattered depressed pale pubescence on the fifth and sixth segments (where the usual *Tabanus*-like side-flecks should be), as well as on the sidemargins; otherwise the fifth and sixth segments bear rather longer more erect black pubescence, and the small seventh segment also bears some longer erect black hairs. Ventre brownish orange on the four basal segments excepting of a small blackish spot at the middle of the base, this black spot usually occupying the first segment and anterior part of the second segment, but sometimes extends near the hind margin of the second segment; the three apical segments brown or blackish with very narrow actual hindmargins yellowish; pubescence dense short depressed pale yellow, but on the seventh segment there are some longer erect black hairs which slightly extend up to the sixth segment.

Length: 15-16 mm.

Male. Head rather large about as wide as the thorax; frons greyish white, glistening when seen from above but blackish brown

when seen from below, quite bare, when seen from front with large obscure splashes about the eye-angles and with a slight darkening between the antennae and eyes, extending up between the eyes where it is rather blackish and is narrowly pointed, very slightly elevated but slightly hollowed out between the eye-angles and with rather inconspicuous very fine longitudinal furrow; face greyish yellow brown with somewhat ashy hue, not elevated but rather hollowed excepting the narrow side parts and the moderately produced jowls; cheeks rather broad, darker, and with an indefinite paler eyemargin extending from the antennae down the sides of the face right round until half-way up the back of the head, and clothed with rather dense and rather long black hairs which are bleached at their tips, and which extend right round beneath the eyes but become rather shorter and stiffer as they approach the lower part of the back of the head; just the inner sides of the cheeks with pale greyish yellow hairs which overhang the sunken bare epistoma which is rather small and much greyish, and has the rather large and somewhat deep lateral pit at the middle of the side-margins; mouth margin rather narrowly and the back of the mouth wholly and extensively clothed with longer shaggier yellowish grey hairs, which extend up quite at the back of the head and mingle with the similar pubescence on the prothorax, but the hollowed-out back of the head bears some shorter thin greyish hairs; the part beneath the back of the eyes and up the lower third of the back of the head only very slightly puffed out, while the upper two-thirds of the back of the head are hollowed out behind the eyes; the lower third of the back of the head bearing a very short almost imperceptible black postocular ciliation, but above that a rather close more erect pale postocular ciliation can be seen which is still very short for the middle third, but which grows slightly longer though still short about the top third, nor does it become perceptibly longer behind the vertex except for a slight fringe at the actual corner of the eye; vertex small, deeply sunken, but almost entirely occupied by an oblong distinctly elevated

shining chestnut ocelligerous tubercle, behind this there is a very few-black pubescence slightly bent forwards. Proboscis thick and short, about two-thirds as long as the depth of the head, with numerous somewhat dense long somewhat shaggy dark brown hairs on the posterior side of the stalk, and with sparse shorter quite erect yellowish brown pubescence on the under side of the sucker-flaps. Palpi a little longer than the proboscis, greyish black with the inner and upper sides and the tip of the second joint reddish yellow or greyish yellow; basal joint much darker, slightly longer than the half of the second joint, clothed with long dense yellowish pubescence, intermixed with similar blackish hairs which are sometimes very abundant and extend behind to the base or often less numerous and only on the apical half; second segment broadly oval, not twice as long as broad, ending bluntly or in an inconspicuous point, clothed with pale long pubescence which is intermixed with similar but black hairs about the outerside and at the tip, and which almost all is sometimes replaced by black hairs leaving a few pale hairs about the base. Antennae much shorter than in the female, mainly reddish orange but the basal joint and the apical half (or less or more) of the third joint darkened; basal joint light greyish black but rather obscurely reddish or yellowish beneath, fairly extending cap-like over the second joint, and bearing dorsally several long black hairs and numerous short ones, but on the sides and beneath with some moderate black hairs about the tip, and on the rest shorter hairs as on the upper side; second joint about one-third as long as the basal joint sometimes obscurely reddish or yellow, with a rather dense circlet of short black bristles round the tip, which are longer below than above; third joint reddish orange, sometimes blackish dorsally and about the tip, but all the style rather dark brown or blackish which is about three-fourths as long as the basal annulation and rarely bears one or two tiny blackish bristles at the tip of each annulation especially on the longer conical apical annulation, the basal annulation large, about two-thirds as

broad as its length at the hump, with the dorsal hump near the base distinct but hardly pointed or hooked and bearing some tiny black bristles.

Thorax brownish or greyish black, slightly shining, with very faint greyish stripes before the suture which are best detected when seen from behind, when they can be traced on the front part as two rather narrow stripes very wide apart with perhaps a middle stripe between them being seen as a very narrow brownish line, but the outer stripes are inclined to curve round in front so as to join the broader grey side stripes which are distinct only before the praealar calli; praealar calli large and obvious though rather less ferrugineous; scutellum black, slightly shining, but slightly dusted with greyish on the disc. Pubescence longer and more dense than in the female, but much less composed of pale yellow hairs along the sidemargins, while the disc there are more sparse very depressed thin greyish hairs; pubescence on the scutellum mainly black about the tip; that on the pleurae more dark, sometimes almost black on most of the mesopleurae, but with less conspicuous large tufts of yellowish or greyish hairs on the pteropleurae and especially on the metapleurae, while pubescence on the intermediate space yellowish.

Wings, squamae, and halteres as in the female.

Legs coloured as in the female, but pubescence longer and more conspicuous and less pale on the hind femora and tibiae; pubescence on the front coxae mostly black but intermixed with numerous long and yellowish grey hairs about the outer basal part; the tiny pubescence on the front tibiae mainly black throughout but on the extreme base there is a few pale one intermixed, and on the middle tibiae with long delicate not dense black pubescence all over, but especially beneath and outside (though not so conspicuous) as in *T. tropicus*; hind tibiae with short pale pubescence at just the base, and with the dorsal ciliation much strong and coarse, black all the length except at just the base, and with a finer less conspicuous partly pale

ciliation beneath except on the apical quarter, and with a not very conspicuous thin sparse longer almost outer-ventral ciliation; the tiny inner-dorsal and dorsal bristles on the hind tibiae are mostly yellow on the basal two-thirds with only scattered black ones intermixed, but on the last third they are all black.

Abdomen less quadrate than in the female because the fifth and sixth segments are very much narrower than the preceding one, and rather pointed at the tip, and with slightly less extended pale orange colouring because the black dorsal line (though narrower especially on the third joint where it is only about middle nineth or tenth) is more defined and becomes more distinct on the hind half of each segment through the smaller extent of the rather vague triangles of pale yellow pubescence, but sometimes the middle quarter of the abdomen may be darkened by a parallel-sided dorsal stripe to the end of the fourth segment, though the usual reddish markings are still quite traceable, and this makes the whitish triangles more distinct, even on the fifth segment, and the sides of the abdomen is clothed with conspicuous black hairs on each segment, and the whole abdomen appears to be more brownish because of the universal long black pubescence on the whole of the segments excepting of a very few inconspicuous short pale hairs at the sides of the each segment where the usual grey side-flecks occur as in *Tabanus* and of the very few inconspicuous orange fringes on the hindmargins of the segments. The hindmarginal fringes brow a little longer at the hind corners of the fourth segment, and on the fifth segment with longer and more restricted to the side-quarters; sixth segment with longer yellow hairs on just the sidemargins; side-marginal pubescence black, except narrowly at the ends of the segments and on the sides of the sixth segment, and the short black pubescence darkens the sides of the second, third, and fourth segments. Ventre orange on the four basal segments except for a small black spot at the middle of the base, but the end segments all blackish; pubescence short, dense, and pale yellow, but longer and all black on the basal

black spot; seventh segment with numerous longer stiffer black hairs all about the middle, sometimes the fifth and sixth (or even slightly the extreme base of the fourth) segments bear a few similar black hairs about the middle near the base. Genitalia with a pair of greyish brown or brownish black two-jointed lamellae, of which the basal joint is orange beneath, and the subquadrate widened end-joint has an orange end or is wholly orange, bearing pale yellow hairs at the apical lower margin.

Length: 14-15 mm.

This species varies but very little in width and in intensity of the dorsal black stripe down the abdomen; in colouring of the palpi of the male, and in the amount of the short black bristles on them in both sexes; in the colouring of the antennae, and in the amount of the black hairs or bristles on the two basal joints; in the amount of the black pubescence on the tibiae; and in the size of the middle blackish spot on the belly. *T. distinguendus* is very closely allied to the most reddish form of *tropicus*, but it may be distinguished by its still more reddish abdomen, by the less black pubescence, and tiny bristles on all the tibiae, by its larger less black-bristled palpi, and by its eyes with only two bands in the male.

This fly does not occur throughout Japan, but its occurence is restricted in the northern parts, Hokkaido and Sakhalin, according to my investigation of Prof. Matsumura's large collection and mines. It may appear only in July and August, and the female usually attacks horses or cattle, but apparently not very violently, while I found her bite rather severe, although not painful.

In Japan, this species is usually known as *Tabanus tropicus*, Meig., but it is a quite mistake, and it must be corrected as *distinguendus*. I carefully examined a number of specimen determined by Prof. Matsumura as *tropicus*, and I found two distinct species in them, many of which were, no doubt, *T. distinguendus*, and others may be a reddish form of *T. tropicus*.

Subg. **Atylotus**, Ost.-Sack.

Mem. Boston Soc. Nat. Hist., II. p. 426, 1876.

This is a convenient subdivision of the gigantic genus *Tabanus*, and is an indistinct subgenus more than *Therioplectes*.

Eyes more or less pubescent, in life with a single slight cross-band or with a few irregular shifting spots. Head rather large, very convex anteriorly and concave posteriorly, without any ocellar tubercle; frontal callosities present or wanting. In the male, the difference in size between the large and small facets is considerable, though it is not so very much as in some species of *Tabanus* (sens. str.). The wings hyaline; the upper branch of the cubital fork, knee-shaped at the base, with a recurrent veinlet or a tendency to emit a stump of a veinlet; first posterior cell broadly open, never closed.

I have made the above difinition of the Subgenus *Atylotus* after consulting Osten Sacken, Brauer, and Verrall, but it is very incomplete as I have had only a few specimens to hand from the world.

The Japanese species may be easily distinguished from any others of the inclusive genus *Tabanus*, by their mealy appearance, total absence of ocelli, two small roundish frontal calli (which are sometimes wanting), more or less pubescence eyes, orange antennae, and by the recurrent veinlet near the base of the upper branch of the cubital fork, though this last character is said to be occasionally absent.

At present we have only five species throughout Japan, as tabulated below:

Key for Species.

I. Frontal stripe with two small separated callosities.

2. Abdomen brownish orange with a broad blackish stripe ... . *fulvus*, Meigen.

22. Abdomen blackish grey.

3. Abdomen without yellowish marking at sides .... *rusticus*, Fabricius.

33. Abdomen with a large luteous marking at side .....
..... *bivittatus*, Matsumura.

II. Frontal stripe without callosities.

2. Abdomen greyish yellow with a dark median stripe.....
..... *negativus*, Ricardo.

22. Abdomen blackish with a large luteous marking at side ...
..... *angusticornis*, Loew.

1. Atylotus fulvus, Meigen. (Pl. IV, figs. 3 & 4).

(Kiiro-Abu).

Tabanus fulvus, Meigen, Syst. Beschr., II, p. 61, 1820.

Macquart, Recueil Soc. Sci. Agr. Lille, p. 483, 1826; Suit. Buffon, I, p. 201, 1834; in Lucas, Explor. Sc. de l'Algerie, Zool., III, p. 425, 1849.

Duncan, Mag. Zool. & Botan., I, p. 368, 1837.

Zell., Isis, XI, p. 822, 1842.

Gimm., Bull. Soc. Imp. Nat. Moscou, XX, 1, p. 186, 1847.

Zetterstedt, Dipt. Scand., VIII, p. 2940, 1849; XI, p. 4259, 1852.

Loew, Verh. Zool.-Bot. Ges. Wien, VIII, p. 596. 1858.

Bonsd., Finl. Tvaving. Ins., I, p. 111, 1861.

Schiner, Fauna Austr., Dipt., I, p. 32, 1862.

Jarosch., Trudy Kharkoff, XI, p. 343, 1877.

Brauer, Denkschr. Akad. Wien, XLII, p. 169, pl. III, fig. 32, 1880.

Gob., Mem. Soc. Linn. Nord France, p. 29, 1881.

Neuhaus, Dipt. Marchica, p. 44, 1886.

Coucke, Ann. Soc. Ent. Belg., XXXVI, p. 138, 1892.

Villeneuve, Ann. Soc. Ent. France, LXXIV, p. 307, 1905.

Kertesz, Cat. Dipt., III, p. 243, 1908.

Atylotus fulvus, Strobl, Mittheil. Naturwiss. Ver. Steiermark, XXIX, p. 1892, 1893.

Kertesz, Cat. Dipt., III, p. 243, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 133, 1911.

Tabanus alpinus, Panzer, Fauna Germ., XIII, p. 21, 1794.

Curtis, Brit. Ent., VIII, p. 78, 1825.

Walker, Ins. Brit. Dipt., I, p. 41, 1851; List Dipt. Brit. Mus., V, suppl. I, pp. 155 & 160, 1854.

Kertesz, Cat. Dipt., III, p. 243, 1908.

Tabanus rusticus, Meigen, Syst. Beschr., II, p. 60, 1820.

Kertesz, Cat. Dipt., III, p. 243, 1908.

Tabanus sanguisorba, Harris, Expros. Engl. Ins., p. 28, pl. VII, fig. 3, 1782.

Kertesz, Cat. Dipt., III, p. 243, 1908.

Atylotus bituberculatus, Bigot, Mem. Soc. Zool. France, V. p. 659, 1892.

Tabanus Ayrrhus, Matsumura, Thous. Ins. Japan, II, p. 71, pl. XXII, fig. 2, 1905 (pt.); 大日本害虫全書, 後編, p. 73, pl. I, fig. 1, 1914 (pt.).

A very handsome golden-hued fly with mainly ferruginous abdomen, and with mainly orange yellow legs, very distinct from any other Japanese species.

Female. Head a little broader than the thorax, moderately arched. Frontal stripe very narrow, parallel-sided, and about four times longer than broad, and the callosities two, separated from each other, shining black, small roundish (but the upper one usually much smaller and dot-like), with an inconspicuous fine longitudinal furrow connecting them, these two callosities especially the upper one being often almost hidden under the yellow tomentum; frontal stripe yellowish brown, and bearing rather abundant golden orange short depressed hairs which are intermixed with abundant black bristly hairs about the upper two-thirds of the stripe; vertex somewhat blackened and bearing much more numerous curved longer (but still short) black bristles, in the middle there is an inconspicuous small elevation but not shining; frontal triangle covered with a golden dust and almost always bare from a distinct pubescence, with a fine longitudinal furrow between the lower

callus and furrow just below the antennae, passing the space between the antennae. Face whitish yellow, in profile moderately concex; side-cheeks sometimes deep yellow, narrower than the half of the epistoma which is about as long as broad; pubescence on the cheeks, jowls and epistoma pale yellow but sometimes brownish yellow or orange, suberect but on the latter rather depressed, and the pubescence always becomes longer on the jowls and about the mouth-edge; back of the head hollowed out leaving a very narrow rim behind the eyes on which is a very short dense orange yellow postocular fringe, and this fringe is almost as short on the upper part as on the lower; back of the vertex with several short though longer than the postocular fringe yellowish brown hairs. Proboscis dark brown, very much shorter than the depth of the head, with rather few yellowish pubescence beneath the stalk, and with somewhat conspicuous longer whitish hairs on the lower surface of the sucker-flaps; palpi about as long as the three-fourth of the length of proboscis, pale yellow; first joint globular, furnished with long yellow hairs as those on the jowls, with a very few black hairs intermixed on the upper part; second joint long and hanging straight downwards, peg-shaped, thickened on the basal three-fifths but afterwards diminishing to a thin conical point, covered with numerous though not dense short black adpressed bristles with some shorter glistening golden ones intermixed except about the tip, while some longer thin golden hairs occur about the basal half of the under-side. Antennae orange with two paler basal joints; first joint covered with a rather sparse somewhat long pale yellow pubescence, and with short black dorsal bristles; second joint very short, shorter than the half of the length of the first joint, with a very few short black apical bristles especially on the innerside; third joint slightly shorter than three times of the two basal joints together, usually deep reddish yellow, the basal annulation about as long as twice the following annulations together, with the dorsal hump obvious and occuring much near the base than the middle and with (or sometimes without) some minute

black bristles on it; style-like portion usually somewhat darker, with its last annulation conical and not very thin and with microscopical apical bristles. Eyes large, in profile strongly convex below and somewhat deeper than broad, apparently bare from pubescence; facets all equally small.

Thorax roundish, brownish black or greyish black, but usually rather grey on the front part, clothed with dense brownish yellow or deep orange yellow pubescence which becomes paler towards the front part and which grows up much longer and shaggy towards the sides especially above the bases of wings, and with numerous but inconspicuous erect black hairs all over except on the front part; humeri moderate in size and with numerous long and erect paler pubescence; praealar calli distinctly densely covered with a brownish yellow or slightly greyish brown-yellow dust, and bearing an abundant long curved shaggy brownish yellow pubescence which is intermixed with similar though rather stout black hairs; postalar calli clothed with very numerous long hairs similar to those above the wing-bases; scutellum usually much more yellowish, clothed with brownish yellow and black hairs as on the disc of the thorax, but these hairs always become longer around the margin. Pleurae ashy grey or sometimes greyish black, with long dense pale brownish yellow or orange yellow pubescence on the upper hind part of the mesopleurae and on the upper and hind parts of the metapleurae, close to the tuft on the squamae, but more sparsely and paler pubescence elsewhere; prothorax covered with numerous but not so dense as in the meso- or meta-pleurae long hairs.

Wings quite clear, but the base and the costal and subcostal cells yellowish; veins yellow, but the costal vein and all the thin veins after about the middle of the wings dark brown; upper branch of the cubital fork almost always with a conspicuous or sometimes rather long recurrent veinlet; first posterior cell widely open but somewhat narrowed at the wingmargin; anal cell closed rather long before the wingmargin. Squamae in the alar pair light brownish glassy with a dark

margin and a short yellowish grey fringe, and in the thoracal pair pale greyish yellow with a yellow margin and a conspicuous tuft of long orange yellow hairs about the angle. Halteres pale orange with the dark orange or reddish yellow knob.

Legs reddish orange, with the blackish coxae except for the extreme apex or sometimes more and about the apical half for the front tibiae, but brownish on the trochanters, on the apex of the middle and hind tibiae, on the middle tarsi and on the hind tarsi which are usually paler at the bases, while the front tarsi deep brownish black, and with an irregular brownish black spot on near the lower base of the middle and hind femora, this being sometimes quite obscured by a greyish yellow dust, all the coxae dusted with grey. Pubescence on the front coxae numerous but not dense, sloping, yellowish white, becoming considerably longer about the base; on the front femora somewhat long and dense behind, yellowish grey about the base but growing blackish about the tip (sometimes almost all black), and the bare subfemoral space narrow and inconspicuous with numerous tiny bristles on its inner margin; front tibiae covered almost all over with short depressed black bristles, which are intermixed with similar but orange yellow hairs about the basal half; pubescence on the middle femora orange yellow, moderately long and dense, but becoming shorter towards the upper surface, and with a few similar but black pubescence intermixed on the upper apical half especially at the apical margin; middle tibiae with the small depressed black bristles scattered all over and with rather dense still smaller glistening yellow ones intermixed about the basal two-thirds, spurs rather large, unequal, orange yellow with the pointed top blackish; pubescence on the hind femora almost all orange yellow, conspicuously longer towards the underside, and with only a few black hairs about the tip and also with very few (usually three or four) longer stouter black bristly hairs on the basal underside; hind tibiae mainly clothed with an abundant dense sloping short orange yellow pubescence all over, and with numerous black bristles intermixed

especially on the upper side; tarsi with tiny black bristles, but with orange ones on the soles of the posterior pairs. Pulvilli yellowish brown; claws blackish.

Abdomen longer than the head and thorax (including the scutellum) together, somewhat parallel-sided but gradually narrowed towards the rounded apex. Dorsum brownish orange with a more or less broad (about one-third the width of the abdomen) blackish dorsal stripe, and with the tip blackish, but with all the actual sidemargins orange; this dorsal strip begins on the whole breadth of the basal segment and contracts to about the middle third (or fourth) of the hindmargin of that segment, and then gradually widens to the end of the third segment, the fourth and subsequent segments being almost entirely blackish, though the orange hue may extend somewhat down the sides of the dorsal stripe on the fourth segment, and the blackish sides of the fourth segment may extend faintly upwards near the sides of the third segment, and there may be a small round isolated blackish spot near each side of the second segment right in the middle of the orange part. Pubescence all over composed of moderately dense depressed glistening deep orange yellow hairs, amongst which abundant though inconspicuous more bristly black hairs occur, which are sometimes somewhat conspicuous on the lateral margins of the broad dorsal stripe so that there are two narrow blackish dorsal stripes, and which are longer and when viewed sideways conspicuous and erect on the basal part of the middle part of the disc of the second segment and very few (or sometimes wanting) on the basal segment, and also which almost always disappear about the brownish orange basal markings except on the isolated blackish spot on the second segment and about the middle of the orange part of the basal segment; side marginal pubescence all orange except for a slight blackish tuft at each side of the basal segment; the dense orange pubescence and dust sometimes obscure the black dorsal stripe and tip. Ventre greyish black but thickly covered with a brownish yellow tomentum and with the hindmargins

very narrowly but obviously yellow, clothed all over with very short adpressed yellow pubescence except about the base where the pubescence is longer and not adpressed; the sides of the three basal segments broadly dull orange though separated from the sidemargins of the second and third segments by large or small blackish side-marginal spots; the flattened seventh segment with abundant longer erect but curved black bristly hairs about the large middle which slightly extend up to the sixth segment and which sometimes are not conspicuous.

Length: 13.5-15.5 mm.

Male. Altogether more paler than the female. Head very much arched, considerably wider than the thorax, and more or less larger than in the female. Frons pale greyish yellow, quite bare, depressed for a large central space, with a distinct narrow longitudinal furrow through the whole length, which is often inconspicuous at the depressed space. Face pale greyish yellow with a faint tinge of greenish grey, bearing long abundant pale yellow white pubescence which becomes much longer about the mouth and jowls, and which becomes sparser and shorter at a large part of the epistoma and almost bare at its middle and upper parts; cheeks broad, moderately puffed out of the eyes; epistoma sunken between the cheeks, narrowed above, the distance between the pits about as wide as the cheek; back of the head ashy grey but near the eyemargin somewhat yellowish deeply hollowed out behind the eyes and with only a microscopical brownish yellow postocular fringe; vertex greyish yellow with its point blackish, small but distinct, and with some distinct though short pale yellow pubescence on and just behind it. Proboscis small but apparently longer than the epistoma, blackish grey with deep brownish black sucker-flaps which bear a few distinct though short blackish bristles on the lower surface; palpi long but about half as long as the proboscis, yellowish white with the basal joint at the outer side blackish; second joint elongate elliptical and fairly pointed, and clothed with numerous short sloping black bristles on all the outerside except towards the upper part

but with longer pale yellowish hairs about its base; basal joint also with long pale yellow hairs. Antennae as in the female, but the third joint narrower, orange; two basal joints with short black dorsal bristles, but on the outside of and beneath the pale basal joint there are longer yellowish hairs and on the apical margin of the second joint there is a distinct circlet of tiny blackish bristles; third joint slender than in the female, with the distinct small black dorsal bristles on the basal joint almost present, and with a very elongate conical apical annulation of the third joint, which is about as long as the three preceding annulations together. Eyes very large, touching for a very long space (about two-thirds the distance from the occiput to the antennae), clothed with somewhat dense minute whitish hairs; facets anteriorly and on almost the upper three-quarters much longer than those on about the lower quarter and on a rather broad zone which extends all up the hind-margin to the vertex and which is almost the same width throughout the length, the transverse dividing line between the facets being sharply defined and sloping down from the front part until it curves round to the hindmarginal zone.

Thorax darker than in the female, but obscured by more ashy grey or ashy brown dust; pubescence almost all brown or greyish brown, suberect and tangled, which is intermixed with inconspicuous erect black hairs and also with a few very short somewhat depressed deep golden yellow hairs all over except on the front part; humeri and praealar calli pale reddish brown though they are densely covered with a ashy grey tomentum, bearing long and shaggy pale pubescence on the former and much longer and shaggier yellowish brown and blackish hairs on the latter; above the wing-bases and postalar calli there are rather numerous sloping brownish yellow hairs (though much fewer and less conspicuous than in the female) with very conspicuously abundant erect black hairs intermixed; scutellum clothed, dusted and pubescent as on the disc of the thorax; pleurae ashy grey or yellowish ashy grey, the pubescence longer and much more denser than in the female.

Wings and squamae as in the female, but the halteres almost always pale orange with the knob not darker.

Legs mainly orange, but blackish on the coxae, on nearly the basal half of the front femora, on quite the basal half of the middle pair, on more than the basal half of the hind femora, on about the apical half of the front tibiae, and on the tip of the posterior tarsi (begining to darken soon after the basal joint), while the front tarsi are deep black; trochanters brownish; the blackish part on the femora and on the posterior tibiae very often disappear, and in such a specimen the trochanters are usually orange in stead of brownish and the front tibiae are blackish only on the apical one-third; these dark portions are not well-defined. Pubescence on the front coxae greyish yellow, considerably long and shaggy, but slightly becomes short and sparse at the apex; the front femora with long and somewhat dense greyish yellow pubescence about the base of the outerside, which becomes blackish about the top, and the bare subfemoral space rather narrow (though broader than in the female) not furrowed and somewhat inconspicuous with an inconspicuous fringe of minute black bristles on its inner margin; front tibiae with a few black hairs on the upper-outer margin, but otherwise covered almost all over with short depressed black bristles, and there are very few scattered touch-hairs near its tip and on the front tarsi which are clothed with depressed tiny black pubescence all over; pubescence on the lower and outer sides of the middle femora longer and denser than in the front femora, greyish yellow; middle tibiae with a slight fringe of longer black and yellowish hairs on the upper-outer part and with small depressed black bristles more scattered and with still smaller glistening yellowish ones intermixed, the spurs with black tip and more slender than in the female; pubescence on the outerside of the hind femora less dense but longer and more extended to the underside, and with only a few black bristles about the tip of the upper side; hind tibiae with a conspicuous even black dorsal fringe, and the underside with a shorter finer mainly pale ciliation

which sometimes intermixed with very few scattered short black bristles, and with tiny glistening yellow bristly hairs on the outside; two posterior tarsi with tiny black bristles but orange yellow ones on their soles. Pulvilli dark greyish; claws black.

Abdomen somewhat conical. Dorsum brownish yellow or orange yellow, with a black dorsal stripe which is usually narrower than in the female, and which becomes gradually narrow to the end of the third segment and rapidly widens to near the posterior margin of the fourth segment, the following segments entirely blackish, the blackish sides of the fourth segment usually hardly touching the basal margin of its segment but very rarely faintly extended upwards the third segment; the isolated dark spots on the third segment almost always do not occur, but in the darker specimens there is a very inconspicuous spots on both the second and third segments, being rather distinct on account of the black hairs; the sidemargins orange yellow, rather broader than in the female. Pubescence on the dorsum composed of moderately dense sloping glistening orange thin hairs and of abundant more bristly black hairs, but the black hairs much more numerous and more distinct than in the female though hardly occur on the middle of the disc of both the fourth and fifth segments; sidemarginal pubescence more conspicuous, outspread, and brownish orange or pale orange except for the blackish hairs at the sides of the basal segment; the black dorsal stripe often dentate at the lateral margin where almost always there is no special black pubescence as in the female, and with the black tip sometimes obscured by the dense orange pubescence. Ventre greyish reddish brown or greyish orange with a more or less broad continuous blackish middle stripe which however may only extend to the second segment or to a point on the third segment, the remaining one or more segments being then wholly orange and the apical two or three segments blackish; in the darker specimens the middle stripe interrupted only at the middle of the third segment, and continued with the apical blackish space; pubescence short, sloping

(though longer than in the female), dense, and pale yellow, which grows up longer and more conspicuous about the middle of the basal segments, the apical black bristly hairs almost always more conspicuous than in the female. Genitalia ferruginous though slightly dusted with whitish, with two jointed lamella on each side, the basal joint transverse, and the apical joint oblong.

Length: 13.5-15 mm.

Among our entomologists, this species has unfortunately been very much confused with *Tabanus pyrrus*, Walker (= *ditaeniatus*, Macq.), but it is easily distinguished from the latter, by the absence of the lateral stripes (though sometimes appear apically), by its large blackish tip of the abdomen, by its comparatively narrow frontal stripe, by its golden pubescence almost all over the body, by its black bristles on the palpi, by its darker legs, by its less arched head, and by many minor points; while the species is identical with *T. fulvus* from Europe, being only slightly different from it in some minor points as already described. The forms from Hokkaido are usually of a more golden hue than those from Honshu, and are undoubtfully identical with *fulvus*, but two specimens (male and female) from Misaki vary very much in appearance from the others, with rather whitish pubescence and having the faint lateral stripes not reaching to the basal abdominal segments, hence it may be a distinct species. There two, however, are probably the same as the northern forms, as some intermediate forms have been found.

This handsome species usually occurs in Japan from June to September, and the females bite horses and cattle in pasture; it is noticed by our veterinary surgeons that this species may be a transmitter of a certain infectious anoemia of horses.

2. Atylotus rusticus, Linne. (Pl. III, fig. 8).

(Nobira-Abu).

Tabanus rusticus, Linne, Syst. Nat., ed. XII, p. 1000, 1767.

Mueller, Zool. Dan. Prodr., p. 179, 1776.

Schrank, Enum. Ins. Austr., p. 479, 1781; Faun. Boica, III, p. 154, 1803.

Fabricius, Spec. Ins., II, p. 458, 1781; Ent. Syst., IV, p. 367, 1794; Syst. Antliat., p. 99, 1805.

Vill., Ent. Linn., III, p. 552, 1789.

Gmel., Syst. Nat., V, p. 2883, 1792.

Panzer, Faun. Germ., XIII, pl. 21, 1794.

Meigen, Klass., I, p. 170, 1804; Syst. Beschr., II, p. 60, 1820 (pt.).

Fallen, Kongl. Vet. Akad. Handl., XXX, p. 242, 1809; Dipt. Suec., Tab. p. 8, 1817.

Macquart, Recueil. Soc. Sc. Agr. Lille, p. 842, 1826; Suit. a Buffon I, p. 207, 1834.

Duncan, Mag. Zool. & Botan., I, p. 367, 1837.

Zetterstedt, Ins. Lappon., Dipt., p. 517, 1838; Dipt. Scand., VIII, p. 2940, 1849; Dipt. Scand., I, p. 119, 1842; Dipt. Scand., XI, p. 4259, 1852.

Zell., Isis, XI, p. 823, 1842.

Gimm., Bull. Soc. Imp. Nat. Moscou, XX, p. 186, 1847.

Walker, Ins. Brit., Dipt., I, p. 40, 1851; List Dipt. Brit. Mus., V, suppl., I, pp. 155 & 158, 1854.

Loew, Verh. Zool.-Bot. Ges. Wien, VIII, p. 596, 1858.

Bonsd., Finlands Tvaving, Ins., I, p. 111, 1861.

Schiner, Faun. Austr., Dipt., I, p. 32, 1862.

Brauer, Denkschr. Akad. Wien, XLII, p. 168, pls. II & V, fig. 31, 1880.

Gob., Mem. Soc. Linn. Nord France, p. 29, 1881.

Pand., Revue d'Entom., II, p. 219, 1883.

Hansen, Fabrica Oris Dipt., pl. I, fig. 7, pl. II, figs. 1, 3, 4, & 9, 1883.

Neuhaus, Dipt. Marchica, p. 44, 1886.

Coucke, Ann. Soc. Ent. Belg., XXXVI, p. 138, 1892.

Villeneuve, Ann. Soc. Ent. France, LXXIV, p. 307, 1905.

Kertesz, Cat. Dipt., III, p. 277, 1908.

Atylolus rusticus, Leonardi, Ins. Noc., III, p. 374, 1900.

Ricardo, Ann. Mag. Nat. Hist. (7), XVI, p. 197, 1905.

Verrall, Brit. Dipt., V, p. 384, 1909.

Tabanus rousselii, Macquart, Dipt. Exot., I, 8, p. 181, 1839; Explor. Sc. de l'Alg., Zool., III, p. 423, 1849.

Walker, List Dipt. Brit. Mus., V, suppl., I, pp. 225 & 229, 1854.

Kertesz, Cat. Dipt., III, p. 277, 1908.

Verrall, Brit. Dipt., V, p. 388, 1909.

A rather small species, easily distinguished by the greyish black abdomen which has two inconspicuous very narrow somewhat darker stripes.

Female. Head moderately broader than the thorax, and shorter than half the thorax. Frontal stripe parallel-sided, little more than four times as long as it is broad, dark ashy grey with slight yellowish tinge, and bearing short somewhat sparse depressed whitish yellow pubescence all over and stout a little longer curved black hairs which do not extend to the part between the upper callus and frontal triangle, and which are usually less conspicuous than those in European species; two frontal calli on the frontal stripe entirely separated, shining black and dot-like, in which the lower one just above the frontal triangle is usually larger and transverse, while the upper one is somewhat longitudinal; vertex without the ocelligerous tubercle but that part is very inconspicuously elevated, and bearing rather numerous black hairs and whitish pubescence intermixed; frontal triangle pale yellowish grey, bare from pubescence, and with a narrow longitudinal furrow in the middle from between the antennae to the lower frontal callus, and at the upper margin with an inconspicuous transverse furrow which is broadly interrupted at the middle. Sidecheeks narrower than half the width of epistoma, pale yellowish grey, with short whitish yellow pubescence which becomes longer, more dense, and pale yellow on the jowls and near them; epistoma in mostly part usually more yellowish than the side-cheeks, bearing a short greyish yellow-white pubescence which

grows longer (but still short) about the middle upper mouth-edge ; back of the head moderately hollowed out, yellowish ashy grey leaving a very narrow ashy grey postocular rim behind which is an inconspicuous short pale yellow pubescence ; the slightly longer hairs about the back of the vertex mainly blackish ; jowls slightly puffed out below the eyes. Proboscis brownish black, about as long as the depth of the head, the stalk bearing a few sparse short blackish pubescence behind and the sucker-flaps bearing more few very much sparser longer (but still short) erect stouter pubescence below. Palpi pale yellow, about three-fourths the length of the proboscis ; second joint long and thin, drooping almost straight downwards and but little curved, moderately inflated on the basal half and then tapering to almost a point, and this joint bears moderate number of short black adherent bristles on the frontal part through the whole length (except for the extreme base), but outside mainly only similar but pale yellowish bristles, and on the posterior side especially near the base some long pale yellow hairs ; basal joint pale yellow and furnished with rather abundant long pale yellowish pubescence. Antennae pale reddish yellow, with basal joint whitish yellow, about three-fourths the length of the head ; first joint about three times of the second joint, bearing dorsally near the tip only short black bristles which very often extend slightly on the outside, and furnished with a very few long (still short) pale yellowish white pubescence below near the tip ; second joint with scarcely more than an apical circlet of tiny bristles ; third joint shorter than the three-times of the two basal joints together ; the basal annulation of the third joint very much dilated and compressed, apparently longer than the style, the dorsal hump near the base with a very few minute black bristles on its tip ; the style slightly darker with a pointed apical annulation which is an elongate conical and is distinctly longer than the preceding annulations. Eyes bearing very sparse microscopical pale pubescence, sometimes so slight as to be almost imperceptible ; eyes in profile shorter than its depth, with a very conspicuously downwardly curved lower margin.

Thorax blackish grey, hardly at all shining and not at all striped, the anterior extremity and humeri being more ashy grey; pubescence composed of rather abundant but not dense short depressed pale grey hairs which become longer and conspicuous above the wing-bases and on the postalar calli down to the scutellum, and which grow more longer and shaggier on the humeri and praealar calli; there are rather abundant suberect longer stiffer black hairs intermixed all over the thorax, these black hairs inconspicuous on the disc unless viewed sideways, but stand out long and conspicuous between the humeri and wing-bases. Scutellum similar to the thorax in colour and clothing, but the pale grey pubescence fairly long and conspicuous round the margin.

Wings clearly hyaline, very slightly pale yellowish about the base and fore part, with pale yellowish veins which are slightly tinged with brownish towards the ends; upper branch of the cubital fork with a very short reccurrent veinlet; anal cell closed a long distance before the margin; first posterior cell widely open but slightly narrower at the wing than at the middle part. Squamae pale greyish white somewhat hyaline, with a yellow margin to the alar pair and a whitish margin to the thoracal pair, and with the usual tuft near the angle whitish yellow in accord with the tuft on the upper part of the metapleurae, and with somewhat conspicuous very short and sparse pale yellowish white marginal fringe on the thoracal pair; halteres pale yellow, with dull coloured knob.

Legs dull blackish brown and pale orange yellow, but the femora and coxae rendered grey by abundant dust; trochanters brownish orange; about the apical one-third (or more than that in the front femora) of all the femora, the basal half or fourth of the front tibiae, all the posterior tibiae (except the faintly darkened tip in the hind one), and the base and underside of the posterior tarsi, pale reddish yellow; front tarsi deep black; bare space beneath the front femora shining orange yellow and the row of minute black bristles on its inner margin inconspicuous. Pubescence mostly greyish white, short and rather

inconspicuous, but on the front coxae, and about the outside of all the femora longer and rather conspicuous; there is a few short or long black pubescence intermixed about the upper surfaces of almost all the joints of the legs espesially on the tibiae conspicuous.

Abdomen flat, very little longer than the head and thorax (including the scutellum) together, blackish grey with two somewhat straight but gradually approach posteriorly to each other blackish stripes and scarcelyany fulvus colouring. Dorsum with the hind corners of the basal segment and the fore corners of the second segment obscurely fulvus, and the extreme sidemargins of all the segments also obscurely fulvus; densely clothed with short adpressed pale yellowish white pubescence somewhat except on the two faint blackish stripes; the blackish stripes leave an intermediate fairly broad slightly grey dorsal space, and the spaces between the blackish stripes and sidemargins are uniformly greyish (without any other blackish stripes), so that (when viewed from behind) the abdomen does not show traces of the usual *Tabanoid* three rows of grey flecks; on the two blackish stripes there is a fair amount of short sloping black bristly pubescence which also appears on the space between the stripes especially on the four posterior segments conspicuous so that a man could describe as the abdoman has a broad blackish dorsal stripe, and also there is a similar but very inconspicuous very few black pubescence on the middle of the space between the black stripes and the sides so that the abdomen does not show the traces of the black lateral stripes; the outer margins of the two black stripes are hardly dentate even though the dark colour widens out slightly at the hindmargins of the second and third segments; the stripes become indistinct on the sixth and seventh segments; submarginal pubescence all greyish white but slightly brownish, longer, and more outspread on the basal segment; seventh segment with fairly conspicuous rigid black bristly hairs, of which there are traces on the sixth segment. Ventre ashy grey, but the three posterior segments yellowish, slightly shining, without any fulvus

colouring near the basal corners; the hindmargin of each segment very narrowly whitish except on the basal segment; pubescence rather dense all over, very short, greyish white, which is conspicuously intermixed with some long, erect, stout, and black hairs on the seventh segment.

Length: 12 mm.

Described from only one specimen of female, from Giodeichi (2nd. Oct. 1914), collected by Mr. A. Nohira.

This species is very closely allied to *latistriatus*, Brauer, and *fulvus* Meigen. The species descrived above is not quite indentical with Norwayan species as it differs from that, by its antennal dorsal hump near the base, by its comparatively broader frontal stripe, by its colouring of the legs, and by its two not bowed (but nearly parallel and outwardly dentate) blackish dorsal stripes on the abdomen. However, as the species is practically identical in many important points as being same to *rusticus*, Linn., I venture to take it as such; but it is easily distinguished from *fulvus*, Meig., by the absence of the conspicuous golden or orange hue, which is so characteristic of that species (especially in life), by the blackish grey abdomen which has no conspicuous fulvus basal markings, by the blackish legs, and by the comparatively narrow parallel-sided frontal stripe; while from *latistriatus*, Brauer, by the absence of the fulvus markings on the abdomen, by the parallel-sided narrower frontal stripe, by the paler antennae which bear much fewer tiny black pubescence, and by the other minor characteristics that as I have already described. These characters distinguishing it from *latistriatus*, may be somewhat invalid, and it seems quite possible that the present species may prove to be a variety of the latter, in spite of the apparent discrepancies in the colouration of the abdomen, but I venture to separate it from that as the species is distinguished in many of important points.

One may think this Japanese species may be an intermediate form between *rusticus* and *latistriatus*. I do not know about its habits yet.

3. Atylotus bivittatus, Matsumura.

(Pl. IV, figs. 1 & 2; Pl. IX, figs. 11 & 12.

(Futasuji-Abu, or Kiiro-Abu).

Thous. Ins. Japan, Addit., II, p. 384, pl. XXII, fig. 12, 1916.

Tabanus pyrrhus (Walk.), Matsumura, 大日本害蟲全書, 後編, P. 73, pl. I, fig. 1, 1914 (pt).

A rather small greyish yellow species, the abdomen yellowish with a blackish brown broad median and narrow lateral stripes, on the median one appear greyish tomentose triangular spots, the lateral stripes not reaching the base of the abdominal side and at apex coalesce with the median stripe.

Female. Head apparently broader than the thorax, arched. Frontal stripe parallel-sided, about four times as long as it is broad, and with two small roundish separated calli, of which the lower one is yellowish brown to blackish, and the upper one is irregular in shape, black, and smaller, being often hidden under the yellowish tomentum; frontal stripe greyish yellow, and bearing short sparse depressed whitish yellow hairs all over and a very few stronger longer (but still short) curved black hairs, but the black hairs do not extend to the part between the upper callus and frontal triangle; ocellar space dusted all over so that no callus is visible, and covered with somewhat conspicuous black hairs; frontal triangle pale yellowish grey, with a fine orange yellow longitudinal median sulcus which extends below to the antennae; face whitish yellow, with a faint tinge of greenish grey, moderately convex, about as deep as wide, with the small lateral pits and somewhat produced reddish brown upper oral margin, bearing fine short whitish yellow pubescence which becomes longer on the jowls and about the mouth; back of the head pale ashy grey with a point yellowish tinge especially on the back of the vertex, and moderately hollowed out behind the eyes, and with a very narrow pale yellowish white post-ocular bare rim, behind which is furnished with a short glistening pale yellowish fringe which becomes much shorter towards the jowls, on

the remainder part there are soft whitish hairs all over the surface, but about the back of the vertex with slightly longer conspicuous black hairs. Proboscis brownish yellow, moderate in size and about two-thirds as long as the deep of the head. Palpi whitish yellow, about two-thirds as long as the proboscis; first joint slightly darker, small, somewhat elongated elliptical, about two-fifths as long as the second joint, and bearing long whitish yellow hairs; second joint long and thin, drooping almost straight downwards and but little bent, moderately inflated on the basal half and then tapering to almost a point, and this joint bears a moderate number of short white adherent hairs on the upper part and about the tip, and on the outside, but on the underside (especially near the base) some longer pale yellowish white hairs; on the upper part of the second joint there are very few short depressed black bristles which vary in number great deal. Antennae pale reddish yellow or orange; basal joint paler, thickened towards the tip and its broadest part about as wide as long, bearing only a few short black bristles on the upper side and some longer pale yellow bristly hairs on the rest; second joint very small, about half as long as the basal joint, with a terminal circlet of short whitish glistening bristles which are intermixed with very few longer black ones on the underside; third joint more than twice as long as the two basal joints together, conspicuously widened at the base and with an obvious fairly prominent dorsal hump just before the middle of its basal annulation, and with one or two inconspicuous minute black bristles on the hump; style-like portion of the third joint slightly darkened (especially at the tip), apparently shorter than the basal annulation, and with its last articulation long and narrowly conical. Eyes in death purplish black or yellowish brown, bearing very short sparse pale pubescence, sometimes so slight as to be almost imperceptible; according to Prof. Matsumura showing a narrow fuscous band which ends at the middle of the eye; eyes in profile about as long as deep, frontal margin stightly curved forwards and as long as the hind margin, the lower margin strongly curved

below, the top angle about 90° but slightly rounded, and the frontal angle obtuse; when seen from in front wider than deep, the frontal margin straight and as long as the facial margin, the frontal angle about 135°, the top angle about 80°, the outer angle narrowly rounded and the lower angle about 115° but rounded.

Thorax slightly longer than wide with the rounded angles, ashy grey or pale yellowish grey, hardly at all shining and not at all striped; pubescence composed of rather abundant dense short adpressed pale yellowish grey hairs which become longer and more conspicuous above the wing-bases and on the postalar calli down to the scutellum, and there are usually no black hairs but very rarely intermixed all over with very few suberect stiffer black hairs which are inconspicuous on the disc (unless viewed sideways); humeri and praealar calli paler, and furnished with numerous long shaggy pale yellowish hairs; pleurae dusted pale grey and bearing pale yellowish grey pubescence (amongst which no black hairs are to be found) which becomes much longer and denser at the posterior-upper margins of the meso-, ptero-, and meta-pleurae.

Wings quite hyaline, with the yellowish veins; upper branch of the cubital fork with a distinct rather longer recurrent veinlet near the base; posterior cells all widely open, and anal cell closed with a long petiole; discal cell slightly longer than the second posterior cell. Squamae in the alar pair very slightly smoky with a reddish brown margin; thoracal pair whitish with a very pale yellowish white margin; the short fringes and the long angle-tuft pale yellow. Halteres dull yellow.

Legs pale orange yellow; front femora covered with short whitish pubescence (leaving a rather broad pale brownish yellow bare space on the underside) which is intermixed with a few short black bristles on the upper side, and on the inner margin of the subfemoral bare space there is a short not dense fringe which is composed of black bristles; middle femora pale brownish yellow, covered with numerous short

whitish pubescence which is intermixed with no black bristles; hind femora as in the middle pair but the pubescence much longer; front tibiae somewhat darken towards the apex, clothed with numerous but not dense short black bristly hairs about the apical half, and bearing short whitish hairs on the rest, the black bristles extending towards the base along the upper side only; middle tibiae paler than the front pair, furnished with numerous depressed short whitish pubescence which is intermixed with a few longer black bristles on the upper side, and bearing two rather long brownish black-tipped unequal spurs; hind tibiae in colour as in the middle pair, covered with short whitish hairs all over, which become longer and suberect on the upper and lower margins and there are some much conspicuous black bristles on the upper side; tarsi pale yellowish brown but the front tarsi conspicuously darker, all the tarsi darken at the tip; claws shining black; pulvilli pale yellowish grey. In some specimens the coxae, the apices of the tibiae and the basal parts of the femora blackish grey.

Abdomen slightly longer than the head and thorax (including the scutellum) together, and somewhat wider than the thorax at the base, but gradually narrowed to the blunt apex; dorsum pale dull orange with a broad blackish median stripe from the base to the apex, this median stripe being separated into two stripes by a greyish tomentose stripe composed of the triangular spots on the segments; these two blackish stripes almost always inconspicuous on the first two segments; apical four or three segments or rarely two blackish, this black colour usually extending to the third segment along near the sides; pubescence on the dorsum short, dense, depressed and whitish yellow, intermixed with a few short inconspicuous black hairs which become more conspicuous towards the apex (these black hairs sometimes do not appear); ventre greyish yellow or sometimes blackish grey towards the apex. dusted with a yellowish grey tomentum, and clothed with abundant very short greyish yellow pubescence all over, no black hairs except on the last segment.

Length : 11-13 mm.

Male. Similar to the female, but the abdomen more fulvus, and its dorsal median stripe less broad and only two apical segments blackish. Head conspicuously broader than the thorax and forming just a semicircle anteriorly (when seen from above) with the hindmargin slightly concave, and always longer and usually wider than in the female. Face and side-cheeks whitish yellow with a very faint tinge of greenish grey, bearing fine short (but longer and denser than in the female) whitish yellow pubescence; back of the head greyish yellow or pale yellow and deeply hollowed out behind the eyes, and with only a microscopical greyish yellow postocular fringe which however grows slightly longer on the upper part; ocellar space exceedingly small, dull yellow, and on its back part some short pale brownish pubescence; frontal triangle rather small, whitish yellow with a grey tinge, and depressed on the middle part at where there is an inconspicuous median sulcus. Palpi pale whitish yellow; second joint elongate elliptical, hardly pointed, bearing a few short black bristles on the outside and some longer ones towards the tip as well as numerous long whitish hairs above and (conspicuously so) beneath about the base; basal joint about half as long as the apical one, usually darker, and bearing long whitish hairs. Antennae usually paler and slender than in the female; basal annulation of the third joint narrow and with a short dorsal hump near the base. Eyes clothed with short dense pale grey pubescence, touching from the very small vertex for fully two-thirds of the distance to the antennae; facets on the upper and middle parts much larger than those on the rest, so that the small facets extend over the lower third of the front and very narrow outer parts and continue as a zone (about same in width throughout) all round the hindmargin up to the vertex; the dividing line of the facets somewhat sharply defined.

Thorax and scutellum as in the female, but the pubescence much longer and softer and intermixed with very few long blackish hairs especially on the scutellum. Pleurae more greyish, clothed with dense

light greyish yellow pubescence which is much longer and more denser than in the female.

Wings as in the female. Squamae in the alar and thoracal pairs whitish and with the almost white margins, but in the alar pair with a somewhat brownish margin. Halteres pale yellow.

Legs lighter than in the female and their pubescence longer and much more abundant, on the hind tibiae there are conspicuous fringes composed of black and pale hairs.

Abdomen whitish yellow or greyish yellow, leaving a rather narrow median greyish black stripe and two similar coloured apical segments; the median stripe has almost straight sidemargins, this stripe having a row of pale grey middle triangles (but sometimes the triangles are not seen although in fresh materials); pubescence pale yellowish grey, dense, and sloping, intermixed with a few blackish hairs at the sides of the median stripe and at the middle part of the last segment (these black hairs sometimes do not appear). Belly greyish yellow, with an irregular narrow median blackish stripe which is sometimes wanting, in some specimens the sides of the belly slightly darkened so that there are greyish brown lateral spots on the last four segments; pubescence greyish yellow, and with no black hairs intermixed but on the last segment there are some erect black bristly hairs which very rarely extend to the preceding segment.

Length: 11-12.5 mm.

This species apparently varies considerably in colour of the abdomen both dorsally and ventrally as Japanese specimens are frequently much more ferruginous, but I have seen but little variation in Formosan materials I have examined. It is easily distinguished from *ditaeniatus*, Macquart, by the absence of the lateral blackish stripes of the abdomen, by the distinctly narrower frontal stripe and by the absence of the black hairs on the thorax (especially on the praealar calli and near them), but is closely allied to *A. fulvus* and special attention must be given to the absence of the conspicuous golden or orange hue which

is so characteristic of that species, and the smaller size, while more exact distinctions are given in my description of *A. fulvus*.

I think Coquillett's *pyrrhus* may not be *ditaeniatus* as Ricardo thought, because in the duplicates of specimens sent to the U. S. National Museum by the late Prof. Mitsukuri there is no *ditaeniatus*, but *fulvus* and *bivittatus*.

This species is one of most common species throughout Japan, as I have records from Sapporo, Otaru, Akita, Tokio, Takasago, Kioto, Yabakei, Matsuyama, Taihoku, Horisha, Shoka, and Tamsui, from May 3rd to August 24th. In Formosa the flies are rather common in rice-fields, and the females bite the belly of cattles mostly at afternoon or evening.

4. **Atylotus negativus**, Ricardo.

Tabanus nagativus, Ricardo, Rec. Ind. Mus. IV, p. 137, 1911; Ann. Hist. Nat. Mus. Hung. Budapest, XI, p. 168, 1913.

A medium-sized greyish yellow species, with no callosities on the almost parallel-sided broad frontal stripe, with the uniformly greyish yellow tomentose thorax and abdomen but the median dark ground colour on the abdomen can see through the dust, with no recurrent veinlet in the clear wings, and with the pale reddish yellow legs. Length: 13 mm, in the female; 11.5 - 12.5 mm. in the male.

Female. Face covered with a greyish tomentum and with a white pubescence. Beard scanty, white. Palpi pale yellow, with a black pubescence, stout ending in a short point. Antennae reddish yellow, the first two joints pale yellow, the third with hardly any tooth. Forehead with no callus, almost parallel-sided, about four times as long as it is broad. Thorax and abdomen uniformly covered with greyish yellow tomentum, through which the dark ground colour hardly appears, and with thick short pale yellow pubescence on the dorsum of abdomen, on the thorax it is less thick and replaced chiefly by black pubescence anteriorly, shoulders the same colour. Breast rather

greyer with white pubesence. Underside of abdomen similar but almost devoid of pubescence. Legs reddish yellow, the apices of fore tibiae and the tarsi blackish, the outer tarsi more or less brown, pubescence pale yellow on the coxae and femora, chiefly black elsewhere. Wings clear, the veins very pale yellow and stigma hardly noticeable, no appendix.

Male. Similar but in some of the specimens, owing probably to denudation, black median markings or a black median stripe appear. Abdomen with very little yellow pubescence, almost bare. Eyes large, convex, the large facets occupying fully two-thirds of the surface of eyes, the small ones reaching to the vertex as a narrow border. Palpi pale yellow with yellow pubescence and black pubescence on apex. Frontal triangle and subcallus coloured alike.

This species might possibly belong to the subgenus *Atylotus*, as the paratype in the British Museum has pubescent eyes, though the pubescence is almost rubbed out on the anterior part of the body. I have no specimens. It is known that this species occurs in Formosa (Takao, July 1st., 1907, and Kagi) and Hongkong.

5. Atylotus angusticornis, Loew.

Tabanus angusticornis, Loew, Wien. Ent. Monatschr., II, p. 104, 1858; Ricardo, Rec. Ind. Mus., IV, p. 237, 1911.

Ashy grey to yellow species. Abdomen darker at the base, on each side with luteous spots. Eyes short haired. Forehead very wide, with no smooth callus. Antennae ochraceous, narrow, the third joint angulated above. Legs obscurely luteous, base of anterior femora, apical half of anterior tibiae, anterior tarsi wholly and four last joints of posterior tarsi black. Wings brownish cinereous, stigma and veins dark grown, no appendix. Length of body $5\frac{3}{4}$ lines. Length of wing 5 lines.

Face yellow pollinose and yellow haired. Palpi yellowinsh clothed with pale yellowish and black hairs. Antennae: first joint

produced, black haired, second black above, third ochraceous, narrow, above angulated, hardly forming a tooth. Forehead very wide, yellow pollinose, on vertex and as far as the anterior angle of eyes with very short black hairs, and with no shining callus. Eyes short pilose. Thorax yellow pollinose and yellow haired, intermixed with black hairs, at the base of the wings thicker. Abdomen blackish, slightly yellow pruinose and with a very large luteous spot on each side from the exterior angle of the first segment, and as far as the posterior margin of the third segment, a black spot lying between, which is extended continuous to the anterior margin of the third segment; first segment with the borders of the following segments except the last, and lateral borders of abdomen yellow haired, rest of abdomen black haired. Underside blackish, with yellowish ashy grey tomentum, borders of apical segments luteous, pubescence of abdomen for the most part black, at the base, sides and posterior border of anterior segments yellow haired. Legs obscurely luteous, black haired, anterior femora at base, anterior tibiae on apical half, extreme apices of posterior tibiae, whole of anterior tarsi, and posterior tarsi from apex of the first joint, black. Halteres luteous. Wings brown cinereous, yellow before the first longitudinal vein, stigma and vein dark brown, with an appendix(!), first posterior cell at apex subdilated. From Ricardo's translation.

The type and this species are not known to me, but I think it may be an *Atylotus*, as Ricardo thought.

Subgenus, **TABANUS** (sens. str.).

Zeller, Isis, p. 814, 1840.

The characters of this subgenus are the same as those of the comprehensive genus *Tabanus* (sens. lat.) with certain limitations—Eyes bare, vertex without any ocelligerous tubercle.

Even these two characters are not absolute, as some species have an almost microscopical sparse pubescence on the eyes, and some have faint traces of an ocelligerous tubercle; the distinctions in appear-

ance are, however, sufficient to clearly locate our Japanese species.

This is still an enormous subgenus, even after separating off *Therioplectes* and *Atylotus*, and many species are exceedingly difficult to distinguish. In our species, it is, however, somewhat easy to find the distinctions between allied species. Up to the present time, we have 36 species throughout our Islands from north to south, as tabulated below:

Key for Species.

A. Frontal calli two, never connected.

1. Thorax and scutellum same colour.

2. Abdomen with no bands or spots or almost so.

3. Blackish species.

4. Thorax and abdomen same colour .... *kotoshoensis*, Shir. (n. sp.)

44. Thorax and abdomen different colour, abdomen reddish brown with the apex blackish..... *arisanus*. Shir. (n. sp.)

33. Yellow species ..... *sapporoensis*, Shir. (n. sp.)

22. Abdomen with bands or spots.

3. Frontal stripe very broad with two quite separated broad calli; abdomen with three rows of small yellowish grey spots on the second to sixth segments ... *cordiger*, Meigen.

33. Frontal stripe not very broad with a band and a narrow calli; abdomen with a continuous yellowish median stripe and narrow yellowish segmentations .... *fulvimedioides*, Shir. (n. sp.).

11. Thorax and scutellum not same colour, scutellum covered with white or yellowish hairs.

2. Dark brown species with yellowish-haired scutellum and yellow-haired band on abdomen.

3. Abdomen reddish brown about the base with six narrow yellowish bands .....*fulvicinctus* Ricardo.

33. Abdomen blackish brown with no reddish base.

4. Thorax more greyish with three somewhat conspicuous grey median stripes, abdomen with rather large yellow-haired median triangles .....*humilis*, Coquillett.

44. Thorax at the anterior half dusted with grey, abdomen without distinct triangles .....*iyoensis*, Shir. (n. sp.)

22. Black species with white-haired scutellum and white-haired bands on abdomen.

3. Wings clear.

4. Tibiae covered with very thick white pubescence, abdomen with five white-haired bands .... *quinquecinctus*, Ricardo.

44. Tibiae covered with rather sparse white pubescence, abdomen with six white-haired bands — .....*sexcintus*, Ricardo.

33. Wings tinged with brown on fore border, abdomen with only two distinct white bands..... *bicinctus*, Ricardo.

B. Frontal stripe with one callus which is almost always prolonged towards the vertex by a more or less narrow line.

I. Abdomen with one or more continuous stripes.

2. Species with a broad reddish yellow median stripe on the abdomen. (Medium-sized) ..... *aurotestaceus*, Walker.

22. Species with three narrow greyish yellow stripes on the abdomen. (Medium-sized) ..... *abbreviatus*, Bigot.

222. Species with a rather inconspicuous narrow yellowish median stripe on the abdomen. (Small-sized)...*miyakei*, Shir. (n. sp.)

II. Abdomen with one or more interrupted stripes.

2. Species with median spots on the abdomen.

3. Abdomen covered with black pubesence, frontal stripe narrow with narrow callus.

4. Thorax with three distinct but narrow yellowish stripes, antennae reddish, tibiae reddish brown, yellow median spots very small .....*okinawanus*, Shir. (n. sp.)

44. Thorax with very faint stripes, antennae blackish tibiae

yellowish at the bases, yellow median spots small but distinctly triangular .....*indianus*, Ricardo.

33. Abdomen covered with dense golden yellow pubescence, frontal stripe broad with stout callus, tibiae all dull yellowish .... *sapporoensis*, Shir. (n. sp.)

22. Species with both the median and lateral spots on the abdomen.

3. Abdomen with three grey spots on the first two or three segments only, a larger broader bodied blackish species ..... *mandarinus*, Schiner.

33. Abdomen with three grey spots on the second to sixth segments, reddish brown in the male, blackish in the female.

4. First posterior cell of wings closed with a long petiole ..... *amaenus*, Walker.

44. First posterior cell of wings closed at the margin or very narrowly open .....*takasagoensis*. Shir. (n. sp.)

III. Abdomen with pale bands.

2. Abdomen blackish brown, the first two segments covered with grey tomentum..... *crassus*, Walker (male).

22. Abdomen blackish, with yellowish or whitish segmentations.

3. Wings marked with brown, but not in a form of bands, legs wholly blachish.

4. Wings with a distinct hyaline ocellus in the discal cell, abdominal segmentations greyish... *fuscicornis*. Ricardo.

44. Wings without hyaline ocellus in the discal cell, abdominal segmentations yellowish .....*sauteri*, Ricardo.

33. Wings clear, legs black but with the mostly part of the tibiae distinctly whitish

4. Brownish species, abdomen with five or six whitish median triangles ..... *sanguineus* Walker.

44. Black species, abdomen with only two silvery white-haired median triangles ..... *miyajima* Ricardo

333. Wings slightly tinged brownish, legs blackish but the tibiae reddish brown or dull yellow.

4. Broader species, with continuous large greyish median triangles of the abdomen, and with paler legs .... *trigonus*, Coquillett.

44. Rather narrower species, with interrupted narrow yellowish or greyish median triangles of the abdomen.

5. Abdomen rather brownish without blackish lateral spots..... *exoticus*, Ricardo.

55. Abdomen rather reddish yellow with the apex blackish, and with blackish lateral spots ... *rufidens*, Bigot.

555. Abdomen blackish with reddish lateral spots on the second segment and with very narrow yellowish segmentations ..... *coquilletti*, n. n.

222. Abdomen blackish but at the basal segments reddish yellow or reddish brown, with a continuous yellow median stripe, rather small species ..... *fulvimedius*, Walker.

2222. Abdomen black, with golden-haired bands, very large species .....*chrysurus*, Loew.

111. Abdomen unicolorus or almost so, sometimes darker at the apex.

2. Large species, over 20 mm.

3. Yellowish species ..... *pallidipectoratus*, Bigot.

33. Blackish species.

4. Thorax covered with silvery white pubescence..... ..... *candidus*, Ricardo,

44. Thorax covered with yellowish brown pubescence ... . *birmanicus*, Bigot.

22. Small species, less than 20 mm.

3. Wings quite infuscate .....*perakiensis*, Ricardo.

33. Wings quite clear..... *formosiensis*, Ricardo.

1. Tabanus kotoshoensis, Shiraki (n. sp.)(Pl. IV, fig. 5; Pl. X, figs. 1 & 2).

(Chibi-Abu)

Small species. Frontal stripe with two separated callosities, the lower one elongate-quadrate, the upper one very fine and line-like; ground colour of the whole body unicolorus dull brownish black, except the tibiae which have a large pale yellowish part.

Somewhat allied to *Tabanus formosiensis*, Ric. and *T. humilimus*. Walk. but it is easily distinguished from the former by the broad frontal stripe which has two separated callosities, and from the latter by the less divergent frontal stripe which has two calli, the long and slender antennal third joint, etc.

Female. Head conspicuously broader than the thorax or abdomen, moderately arched, the ground colour blackish but entirely covered with a greyish tomentum. Frontal stripe moderately widened above with almost straight sides, about four times as long as its broadest part or fully seven times as long as its narrowest part, dusted with yellowish grey and furnished with rather numerous brownish black pubescence which is mostly sloping below but there is a few erect one and which becomes shorter and sparser towards the lower callus; the surface inconspicuously convex above, but slightly depressed just above the lower callus; lower frontal callus black and shining, moderately prominent, elongate-quadrate (not transverse), only occupied about the middle half of the width of frontal stripe, the upper callus not conspicuous, very fine and about as long as the lower one, not elevated, black not shining. Vertex somewhat distinguished from the frontal stripe by a minute ocellar tubercle which is elongate-oval and is not clothed by dust, ashy greyish black, furnished with a few scattered black pubescence which is similar to that on the frontal stripe. Frontal triangle slightly inflated, entirely separated into two lateral spaces by a distinct central sulcus, clothed with a yellowish grey tomentum, but

without pubescence. Face covered with a silky white dust and with fairly abundant white thin pubescence which is almost same in length on the whole surface, and which is intermixed with a very few similar but brownish hairs at the upper and outer marginal parts of the cheeks; side-cheeks rather wide about two-thirds of the epistoma at the broadest part, the upper-outer angle slightly tinged with a yellowish dust; epistoma about as long as wide, somewhat prominent; jowls and back of the head clothed with snow-white tomentum, the former rather broad with numerous rather long whitish hairs which do not extend up to the back of the head, while from them a fairly broad bare similarly tomentose postocular rim extends right up to the vertical space, which when viewed from above is puffed out on the upper part of the eyes to about one-quarter as much as the breadth of the frons; behind this bare rim there is a comparatively long black ciliation which (when seen from in front) projects a little above the eyes, but below that part there is only a short inconspicuous pale ciliation which is continued downwards until it emerges into the long pubescence of jowls; this long black ciliation not extends to the occiput; back of the head slightly hollowed out, and with a very few fine whitish pubescence below. Eyes in death greenish black with two oblique dark bands, in profile subroundish, a little higher than it is long, when seen from front wider than depth; the angle at the junction of the inner and lower margins of each eye about 135° and consequently the eyes extending much below the antennae; eye-facets moderately minute, about same in size. Antennae pale orange yellow, with third joint pale reddish yellow, rather slender, slightly dusted with whitish; first joint rather stout, hardly three times as long as the length of the second, with minute black bristle-like hairs which do not extend the under surface and very narrow base, but at the apex of the under surface there is a very few rather long paler hairs; second joint slightly produced forwards at the upper apex, with a circlet of very short black bristles round the apical margin; third joint (without style-like portion) consider-

ably longer than the basal two joints together and about the half as wide as long, with a very blunt dorsal hump which is placed well before the middle (rather near the base) and bearing two or three blackish setae; style-like portion with four distinct annulations, very short but slightly longer than half the length of the rest of the third joint, its top-annulation pointed, brownish black and with two or three blackish bristles at the tip. Palpi dull pale yellow with outerside rather ashy grey, rather large; second joint stout for about the basal half and thence steadily contracting to a sharp point, about two and a half times as long as its stoutest part, distinctly bent just before the middle, and clothed with rather numerous short sloping white pubescence intermixed with scattered depressed black bristles all over the upper and outer parts except on the basal part; first joint rather slender, slightly longer than one-third the length of the second, dull yellowish, obscured by a greyish tomentum and clothed with rather long greyish hairs all over the outer and lower parts. Proboscis brown, slightly longer than the palpi.

Thorax about as long as wide, conspicuously contracted towards the front, covered with a yellowish grey tomentum, brownish but distinctly greyish at the front where there are three very inconspicuous narrow stripes, in which the middle one extends behind the middle of the disc, and its posterior thirds is separated into two lines by a dark elongate-triangular intermediate space, while the outer ones only reach to the suture where they obliquely turn inwards and connect with the middle stripe; at the side there is a broad but vague lateral stripe which only extends on the praealar calli; the surface of disc covered with fairly abundant rather short not depressed fine brownish black pubescence which is long and somewhat shaggy at the sides, and is intermixed with a few golden yellow pubescence which is especially conspicuous at the prae- and post-alar calli; humeri rather small, slightly reddish brown at the lower and hind margins, clothed with rather pale pubescence; praealar calli large, triangular, distinctly ashy grey, with

a rather conspicuous tuft of long blackish hairs about the lower margin. Scutellum triangular, concolorous with the hind part of the thorax, coverd with rather long sloping blackish pubescence with a few yellow hairs intermixed. Pleurae uniformly covered with a greyish white dust, with abundant rather long greyish hairs which become longer and denser above, on the metapleurae and prothorax, and on the hind margin of the mesopleurae there are conspicuous greyish white tufts; between the notum and pleurae there is a right-angled yellowish brown elevation from the hind corner of humerus to before the wing base, the part bearing a very few whitish hairs.

Wings large, slightly shorter than the length of the body, glassy, somewhat greyish, with yellowish veins but costal and ambient veins slightly dark; stigma yellowish; discal cell rather small, shorter than the second postical cell but wider; the upper branch of the cubital fork without veinlet; posterior cells all wide open, not contracting at the margin; anal cell closed long before the margin. Squamae greyish, with the dark brown margin and with a very fine brownish fringe which grows into the usual long yellowish tuft about the angle; thoracal pair somewhat yellowish with a yellowish brown margin and a pale fringe. Halteres yellowish brown with pale stalk and tip.

Legs black, more or less covered with a greyish dust; coxae conspicuously obscured by a whitish tomentum, and furnished with greyish hairs which on the front pair conspicuously become longer and fairly abundant; trochanters yellowish brown; femora black with pale brown tips; tibiae yellowish except about the apical one-third of front pair blackish, and about the tip of two posterior pairs brownish; tarsi blackish brown but in the front pair deep black; pubescence on the front femora mainly blackish, rather numerous, longer though rather sparse on the outside, and shorter but dense on the upper and inner sides, at the upper-outer margin there is a rather inconspicuous very sparse ciliation of white hairs, this ciliation being not extend through the whole length but only basal two-thirds, and with a rather

sparse row of rather long blackish bristly hairs on the inner margin of the shining black bare space which is rather broad and transversely striolate but entirely not hollowed; pubescence on the posterior femora all whitish, rather short and depressed, but about the basal half there are somewhat longer and not depressed similar coloured hairs, especially on the under side; pubescence on the front tibiae all depressed, yellow but on the dorsal surface with black hairs intermixed, on the middle tibiae almost all depressed and yellow, but on the dorsal surface there are erect and rather long black hairs scattered, on the hind tibiae almost all black less depressed but with depressed shorter whitish hairs intermixed about the ventral half, the black pubescence on the dorsal surface forming a somewhat conspicuous fringe; front tibiae and tarsi with the conspicuous but scattered touch-hairs, but on the former very few and only at the apex; all tarsi with reddish yellow soles, and with deep orange yellow pulvilli.

Abdomen as long as the head and thorax (including the scutellum) together, and about as wide as the thorax, somewhat parallel-sided with round extremity; dull black, clothed with a greyish brown tomentum above and with whitish one beneath; the hind margins of the both dorsal and ventral segments very narrowly but conspicuously pale brownish, the lateral margin of dorsal segments more or less pale yellowish brown excepting of the first segment; pubescence on the dorsum blackish, intermixed with golden-yellow hairs at the median line through the five basal segments, and at the hind margins of from second to fifth segments, this golden-yellow pubescence being not conspicuous in the type specimen but apparently recognisable; pubescence at the sides of the first and second dorsal segments greyish yellow and long, and at the sides of the rest segments mainly blackish but with a few yellowish hairs; pubescence on the ventre very short, depressed, whitish, on the two apical segments there are long erect black bristly hairs which somewhat extends on the fifth segment.

Length: 8.5 mm.

Described from a single female, from Kotosho, July 20th., 1912, Formosa, in fairly good condition. The female, which bit the neck, has been took by the auther, about four o'clock afternoon, and her biting was rather severe but its effect last with him only two days.

The small-sized *Tabanus* with greyish black body, is easily distinguished from other species of this genus by the almost uniformly coloured and rather short abdomen, by the blackish legs, and by the very long wings.

2. Tabanus arisanus, Shir. (n. sp.) (Pl. IV, fig. 6; Pl. X. fig. 3)

(Hoso-Abu)

Rather small and slender species, brownish; frontal stripe with two separated callosities, about four times as long as it is broad; abdomen yellowish brown with pale central stripe and hind margins.

Female. Head a little broader than the thorax, very slightly arched. Frontal stripe broad, slightly divergent above, with the straight sides, about four and a half times as long as its narrowest part or a little more than three times as long as its broadest part, clothed with a yellowish brown tomentum which is slightly darker at the upper half, and with a few sloping black pubescence which is rather abundant just above the second callus and is intermixed with a very few tiny yellow hairs; frontal calli blackish, the first one somewhat quadrate (not transverse), shining reddish black, hardly touching the eye-margins, the second callus blackish, very narrow, elongate, like a line, very slightly elevated, and about as long as the lonwer one. Frontal triangle somewhat inflated, with a fine distinct median sulcus through the whole length, clothed with a dull orange yellow tomentum and without pubescence; two conspicuous but shallow rather large crescent shaped depressions just above the antennal pits. Face clothed with a greyish tomentum, which is somewhat yellowish at the epistoma and is dull orange yellow at the upper part of the cheeks; the epistoma moderately inflated, a little shorter than the widh, with distinct side-edges

which are not sharp, and with a few brownish somewhat bristly hairs at the upper-lateral angles, and a very fine pale pubescence all over the surface; cheeks not much inflated, rather broad about two-thirds the width of the epistoma, furnished with a few mixed blackish and yellowish pubescence, the blackish one being especially visible at the eye-margins and at the upper and lower extremities; upper mouth-edge slightly sunken. Jowls moderately inflated, broad, clothed with a greyish yellow tomentum, and with long whitish yellow hairs which extend up to the inner parts of the cheeks and lower mouth-edge. Postocular rim rather narrow and sunk behind the eyes and not distinct, extending from the jowls up to the top corners of the eyes; this rim greyish yellow, not equal in width for the whole length, slightly narrowed upwards, with a short pale yellowish brown ciliation immediately behind this bare rim; back of the head very slightly hollowed out, yellowish at the upper half but ashy grey below. Vertex dark grey with black thick pubescence, not inflated and without ocellar tubercle, the yellow pubescence on the frontal stripe being slightly emerged into the black hairs at the sides of the vertex. Eyes in death blackish green, with three narrow deep purplish transverse stripes; the somewhat blunt angle between the frontal and lower margins about 135°, and the upper angle between the frontal and hind margins about 105°; when seen from in front wider than height, the outer margin evenly rounded, the upper margin nearly horizontal, and the lower margin hardly angulate; in profile about as long as height, the upper-frontal margin somewhat straight, and the hind margin moderately rounded. Antennae pale yellowish brown; first joint with numerous short depressed black bristles which become very sparse at the inside and about the base; second joint shorter than the half of the first segment, paler than the basal joint, slightly produced at the upper apex, with a circlet of tiny black bristles; third joint wanting. Palpi very slender, covered with a greyish yellow dust; second joint narrow, about five and a half times as long as its broadest part, slightly

curved, nearly equal in width for the whole length, but the apical one-third very slightly narrowed towards the tip which is not pointed, with rather numerous stout depressed black pubescence all over the upper and outer surfaces but the inner surface quite bare; first joint about one-third the length of the second and slightly narrowed apically and about as broad as the second joint, clothed with a greywish tomentum and with long pale yellowish hairs except for the inner side which is almost bare. Proboscis pale brown, stout, about as long as the palpi, with a rather numerous long erect yellowish brown pubescence behind the stalk, and the sucker-flaps large, about half as long as the proboscis, with a few shorter pubescence beneath:

Thorax longer than wide, somewhat quadrate with rounded angles, blackish, obscured by a yellowish brown tomentum, somewhat greyish at the anterior part, with three very inconspicuous narrow stripes which are not extending behind to the posterior margin, clothed with short blackish pubescence intermixed with golden yellow hairs; the sides slightly pale, with the reddish brown suture; humeri pale greyish yellow, with rather long greyish hairs; praealar calli dark grey with a few long blackish bristle-like hairs; postalar calli somewhat paler than the sides of the disc, furnished with a very few short black bristle-like hairs; just above the wing-bases rather broadly reddish brown. Scutellum triangular with rounded posterior angle, concolorous with the disc of the thorax, covered with rather numerous sloping black hairs intermixed with golden hairs. Pleurae almost evenly clothed with rather sparse long pale yellowish white hairs which become slightly denser and much more conspicuous above, on the prothorax and metapleurae, and on the upper-hind margin of the mesopleurae there are conspicuous yellowish tufts; the angulated elevation between the notum and pleurae not very distinct, yellowish.

Wings longer than the thorax and abdomen together, greyish, with yellowish costal and subcostal cells, and much darker at the posterior border especially at the sides of the radial vein and of the upper

branch of the cubital fork; stigma yellow; veins mostly dark brown but the stem of the cubital vein and postical vein conspicuously yellowish; posterior cells all widely open but the fourth cell slightly contracting at the margir; anal cell closed long before the margin; the upper branch of the cubital fork without recurrent veinlet; discal cell about as long as the second posterior cell but narrower than that. Squamae rather large; in the alar pair glassy grey with a blackish margin and rather longer brown fringe which grows into the long yellowish tuft at the angle; in the thoracal pair yellowish with a brown yellow margin and a very fine pale fringe. Halteres yellowish brown with darker knob.

Legs brown, with the basal half of the first tibiae, tip of the front and hind femora, apical thirds of the middle femora, and posterior tibiae (except the apical portion) yellowish, all these colours being not well defined; front coxae ashy grey, covered with long yellowish grey pubescence; front femora blackish brown, slightly dusted with brownish, with somewhat long not very dense blackish hairs which become conspicuously shorter at the inner side; the bare subfemoral space very broad, distinct and striolate, but not hollowed out through the whole length, at its inner margin there is a conspicuous and dense fringe composed of comparatively long and blackish bristles; pubescence on the posterior femora all yellow, short and depressed, but on the base of the dorsal surface and on the ventral surface there are paler long erect fringes; pubescence on the front tibiae very abundant, depressed and black, and consequently the ground colour of the tibiae obscured by it; on the middle tibiae depressed and yellow, but on the apical half and on the whole dorsal surface with similar black hairs intermixed; on the hind tibiae similar and yellowish, but with a conspicuous somewhat long and black ciliation on the dorsal surface, and on the apical half or more with inconspicuous short black hairs intermixed; front tibiae about the tip and tarsi with a few scattered ot uch-hairs; two unequal spurs of the middle tibiae rather large

blackish brown with the base very slightly paler; all the tarsi with more or less deep yellow soles, and with brownish pulvilli.

Abdomen large and long, about twice as long as the thorax (including the scutellum) conspicuously broader than the thorax, slightly tapering towards the apex though it is somewhat parallel-sided, reddish yellow with dark brown tip; dorsum slightly brownish with a narrow yellowish median stripe from the basal segment to the sixth segment, and each segment with the much narrower similar coloured hind margin, covered with an abundant short depressed black pubescence but on the yellow median stripe and on the hind and lateral margins of each segment there are conspicuous golden yellow hairs, which become somewhat longer and erect at the sides; ventre dusted with grey, and with golden yellow pubescence, on the seventh segment there are numerous long and erect black bristly hairs which do not extend up to the preceding segment.

Length: 11.6 mm.

Described from a single female, in fairly good condition, taken by the author at Arisan (July, 1914), Formosa.

Somewhat allied to *T. borniensis*, Ricardo, but apparently differs from that by a broad frontal stripe which has two separated calli.

When the author was resting upon some timber fallen on the road in a wood, this handsome small *Tabanus* pierced his bare arm, at about sunset. Its puncture was not very severe but its effect continued for fully five days.

3. **Tabanus sapporoensis** Shir. (n. sp.) (Pl. IV, fig. 7; Pl. X, figs. 4 & 5).

(Kiniro-Abu).

Rather small species of yellow, allied to *T. insurgens*, Walk., from New Guinea, in appearance, but distinguished from that by two separated shining blackish frontal calli and by all the tarsi black.

Female. Head as wide as or slightly wider than thorax,

moderately arched. Frontal stripe greyish yellow, but with a blackish sheen on the vertex, moderately contracting from the vertex to the frontal eye-angles and about four times as long as its broadest part or about eight times as long as its narrowest part; pubescence on the frontal stripe deep golden yellow, dense, partly depressed, and partly sloping; lower frontal callus somewhat quadrate long, not touching the eyes, moderately elevated, dark brown to brownish black, shining; upper frontal callus very narrow and long, very slightly raised, almost always quite separated from the lower callus but in denuded specimens sometimes connected with the latter by a fine line, black and shining; frontal triangle shining dull yellow, but almost always with very narrow lateral margins dusted with yellow, and with pale yellow dusted double crescent just above the antennal pits, in the middle there is a fine but distinct longitudinal furrow from the lower frontal callus to the fine edge between the antennal pits; vertex with no ocelligerous tubercle, bearing numerous pubescence which is quite similar to that on the frons but a little longer. Face broad, with slightly puffed out cheeks and with somewhat prominent yellow epistoma, which is subquadrate and contracts at the middle where the lateral pits exist, and which bear distinct yellow pubescence; cheeks yellow but slightly paler and about half as wide as the epistoma, bearing rather short and not very abundant yellow pubescence which becomes longer and denser about the jowls; all along below the eyes and up all the back of the head to the vertex is a comparatively wide dull yellow bare rim, behind which is a rather short though rather crowded ciliation of yellow or yellowish brown hairs which extend on the occiput and which become slightly longer below to the jowls; back of the head distinctly hollowed out, all pale yellow (sometimes ashy grey in paler specimens), and bearing some scattered long pale hairs. Proboscis deep reddish yellow, shorter than the depth of the head, rather stout, with very long yellow hairs behind the stalk, and with slightly shorter but stouter yellowish brown hairs below the brownish black sucker-flaps

which are much longer than half the whole length of proboscis. Palpi pale reddish yellow or yellow, about two-thirds as long as the proboscis, rather stout; first joint slightly darker, covered with numerous long yellow hairs; second joint nearly four times as long as its broadest part, rather broad from the base up to about the middle, after which it droops and gradually diminishes to a blunt point, quite bare on all the inner side but with a few longer pale hairs beneath about the base, pubescence on the outer side dense, short and golden yellow, with a few scattered black bristles intermixed. Antennae short and rather stout, about as long as the palpi, reddish yellow with somewhat paler basal joint; first joint inconspicuously extending rather cap-like over the second joint, where it has reddish tinge, covered with short scattered yellowish pubescence which is intermixed with two or three tiny black bristles on the outer side near the apex; second joint small, about half as long as the basal joint, slightly produced at the upper apical margin, with an inconspicuous circlet of a few inconspicuous black bristles around the tip, these bristles being rather conspicuous on the underside and at the prominent part; third joint about twice as long as two basal joints together, broad, the basal annulation large, the depth of this annulation at the hump being about two-thirds its length; dorsal hump near the base distinct and pointed but not hooked, and bearing some inconspicuous blackish bristles; style-like portion very short, but wholly two-fifths the length of the basal annulation of the third joint, the apical annulation being slightly longer than the others and pointed, on each annulation there are two or three inconspicuous tiny blackish hairs about the tip. Eyes quite bare, in profile apparently shorter than the depth, with largely rounded lower angle; when seen from in front slightly wider than the depth, with the inner angle about 130°, and with the upper angle nearly 90°; facets all equal but somewhat smaller around the margin; in death purplish black, without any markings or bands.

Thorax rather large, subquadrate with rounded angles, slightly

longer than the width, dark grey but obscured by stout depressed golden yellow pubescence intermixed with longer yellowish brown hairs which are very abundant and conspicuous at the anterior part where the depressed yellow pubescence does not ocour ; humeri distinct, greyish yellow, bearing long brownish yellow hairs ; praealar calli large but not very prominent, the upper half bearing depressed dense stout golden yellow pubescence with long upturned brown hairs intermixed especially at the posterior margin, while the lower half bears only long somewhat shaggy yellowish hairs ; on the base of the wing and on the postalar calli there is much numerous stout longer golden yellow pubescence ; scutellum moderate in size, the colour similar to that of the thorax, densely covered with numerous long erect yellowish brown hairs which are intermixed with numerous depressed golden yellow pubescence similar to that on the thorax. Pleurae greyish yellow, furnished with long though thin pale yellowish brown hairs which become denser longer and shaggier on the prothorax, mesopleurae and metapleurae ; at the hind margin of the mesopleurae and at the upper-hind margin of the metapleurae there is a distinct deep yellow tuft of long stouter and shaggy hairs.

Wings about as long as the thorax and abdomen together, clear but very slightly tinged with grey ; costal cell and stigma pale yellow, and along the veins very slightly yellowish especially at the both sides ; costal and subcostal veins brown but the remainings yellowish especially mediastinal, cubital and postical veins ; upper branch of the cubital fork without recurrent veinlet but sometimes exists abnormally ; all the posterior cells widely open ; discal cell moderate, about as long as the second posterior cell ; anal cell closed before the wing-margin. Squamae in the alar pair brownish with a dark brown margin and an inconspicuous pale fringe except the long distinctly yellow tuft about the angle ; in the thoracal pair pale yellowish with brownish margin and with an inconspicuous whitish fringe. Halteres brownish orange, with darker knob.

Legs pale yellowish brown, but the apical one-thirds of the front tibiae and front tarsi black, and the posterior tarsi blackish excepting of the basal half or more yellowish brown; front coxae stout, slightly longer than half the front femora, dusted with yellow but the extreme tip slightly blackish, bearing numerous long yellowish pubescence which becomes shorter about the apical half; front femora on the outside with moderately long yellowish pubescence intermixed with very few scattered black bristles, on the upper side there is a rather sloping fringe of yellow and black hairs, on the lower surface there is a broad shining transversely striolate but hardly hollowed bare space, and inside which is a distinct yellowish brown (black about the apical one-thirds) ciliation, and outwards the bare space there is a fringe of erect longer paler hairs; pubescence on the middle femora golden yellow, long and dense on the outer side but short on the rest; hind femora with moderately long yellowish fringe beneath and with short depressed golden yellow pubescence on the rest; pubescence on the front tibiae yellow and depressed about the basal two-thirds, and with scattered black bristles intermixed, while the apical one-thirds bears only depressed black bristles, on the apical portion of the lower surface there are rather distinct and long touch-hairs; pubescence on the middle tibiae almost all yellow, mostly depressed and some one sloping, at the tip there are a few tiny black bristles above and two unequal large yellowish brown (black tipped) spurs beneath; on the hind tibiae almost all sloping, short, golden yellow, round the tip there are a few tiny black bristles; front tarsi with numerous but scattered long touch-hairs; the soles of the posterior tarsi coppery reddish; pulvilli brown with yellowish tip.

Abdomen slightly broader than the thorax, and gradually narrowed towards the apex which is roundish, not flattened, slightly longer than the head and thorax (including the scutellum) together, dull yellowish with dark apex, but obscured by golden yellow pubescence, without any markings or bands; pubescence on the dorsum very dense

and depressed, but on the two basal segments there are a few erect brownish hairs which are rather numerous on the first segment, the seventh segment with a few scattered curved black bristles near its base; pubescence on the sides somewhat sloping, longer than that on the disc, but similar in colour; pubescence on the ventre much shorter and thinner than that on the dorsum, the seventh segment with numerous stout erect black bristles which extend up to the sixth segment.

Length: 9.8-12 mm.

Described from three specimens of females collected by the author at Jozankei near Sapporo, about three o'clock on an afternoon in August 1906. Two females taken in Ichigo by Mr. A. Nohira (at Akakura on the 8th of August in 1914), no doubt, belong to the same species, but they are distinguished by a prominent process of the upper apex of the second antennal joint, by the absence of the black bristles on the two basal joints of antennae, on about the tip of the posterior tibiae, and on the palpi, by the black bristles on the seventh ventral segment of the abdomen not extending up to the preceding segment, and by a much more golden yellow appearance. The author therefore, took these two females, as a local variety, and named them *splendens* n. var. (Length: 11-12 mm.).

The female of the typical *sapporoensis* bites human beings, but it seems that the effect does not continue for long. In author's case it was only one day's trouble, although he always suffer very much by any biting of dipterous insects.

This species probably is not very common, and occurs only in the northern parts of Japan proper.

4. Tabanus cordiger, Meigen. (Pl. V, figs. 6 & 7).

(Hime-Shirofu-Abu)

Syst. Beschr., II, p. 47, 1820.
Macquart, Recueil. Soc. Sc. Agr. Lille, 9. 447, 1826.
Zeller, Isis, XI, p. 817, pl. I, figs. 10-13, 1842.

Gimm., Bull. Soc. Imp. Nat. Moscou, XX, p. 181, 1847.
Walker, Ins. Brit., Dipt., I, p. 40, 1851; List Dipt. Brit. Mus., suppl., I, pp. 156 & 163, 1854.
Loew, Verh. Zool.-Bot. Ges. Wien, VIII, p. 599, 1858.
Schiner, Faun. Austr., Dipt., I, p. 35, 1862.
Brauer, Denkschr. Akad. Wien, XLII, p. 201, pl. IV, fig. 55, 1880; Denkschr. Akad. Wien, XLVII. pl. II, figs. 32-34, 1883.
Gob., Mem. Soc. Linn. Nord France, p. 23, 1881.
Pand., Revue d'Entom., II, p. 205, 1883.
Neuhaus, Dipt. Marchica, p. 42, 1886.
Strobl, Verh. Nat. Ver. Steiermark, XXIX, p. 17, 1892.
Ricardo, Ann. Mag. Nat. Hist., (7), XVI, p. 199, 1905; Rec. Ind. Mus., IV, p. 239, 1911.
Villeneuve, Ann. Soc. Ent. France, LXXIV, p. 309, 1905.
Kertesz, Cat. Dipt., III, p. 236, 1908.
Verrall, Syst. List Palaearc. Dipt. Brachy., p. 11, 1909.

Tabanus atricornis, Meigen, Syst. Beschr., VII, pp. 59 & 47, 1838.
Zetterstedt, Dipt. Scand., I, p. 107, 1842; VIII, p. 2936, 1849; XI, p. 4259, 1852.
Walker, Ins. Brit., Dipt., I, p. 38, 1851; List Dipt. Brit. Mus., V, suppl., I, pp. 156 & 162, 1854.
Villeneuve, Ann. Soc. Ent. France, LXXIV, p. 308, 1905.
Kertesz, Cat. Dipt., III, p. 236, 1908.

Tabanus latifrons, Zetterstedt, Dipt. Scand., I, p. 106, 1843; VIII, p. p. 2936, 1849.
Walker, List Dipt. Brit. Mus., V, suppl., I, pp. 156 & 163, 1854.
Bonsd., Finl. Tvaving. Ins., I, p. 107, 1861.
Kertesz, Cat. Dipt., III, p. 236, 1908.

Tabanus vicinus, Egg., Verh. Zool.-Bot. Ges. Wien. IX, p. 391, 1859.
Kertesz, Cat. Dipt., III, p. 236, 1908.

Tabanus braueri, Jaenn., Berl, Ent. Zeitschr., X, p. 82, 1866.
Kertesz, Cat. Dipt., III, p. 326, 1908.

Tabanus megacephalus, Jaenn., Berl. Ent. Zeitschr., X, p. 82, 1866.

Kertesz, Cat. Dipt., III, p. 236, 1908.

Medium-sized blackish species with broad frontal stripe which contains two large roundish separate calli, with distinct three rows of small grey spot on the dorsal abdomen, with wholly dusted frontal triangle, with blackish antennae and legs, and with clear wings.

Female. Head large, distinctly broader than the thorax, moderately arched. Frontal stripe yellowish ashy grey or brownish ashy grey, a little darker above, very broad, broadest just above the upper frontal callus and gradually but very slightly contracted towards the eye-angles, and about two and a half times as long as its broadest part or about three and a half times as long as its narrowest part; pubescence on the frontal stripe about down to the lower callus short, black and proclinate, and usually suberect pale on the lower part or sometimes on the lower sides only, the black pubescence being slightly longer on and about the vertex with much longer grey hairs intermixed, and behind the vertex are some much more longer black hairs which have their tips bent forwards; lower frontal callus shining black, large and slightly convex, transverse oblong or sometimes square, resting just above the frontal triangle, and only separated from the eyes by narrow grey lines; upper frontal callus black and slightly shining, flat and irregularly longitudinally striate, broad, usually heart-shaped being notched above, separated from the lower callus by a rather dusted space or very rarely connected below by a short point with the lower callus; vertex somewhat triangularly dark grey, without any ocellar tubercle; frontal triangle rather short and broad, wholly covered with a yellowish grey tomentum, with a brown cross-band extending across from eye to eye both above and below the antennae and continuing somewhat down the cheeks against the eyes. Face wholly obscured by an ashy grey tomentum which becomes slightly yellowish on the epistoma or brownish on the cheeks above, covered with rather long and dense whitish hairs, which become shorter above and are

straight and reclinate on the epistoma, while they are erect on the cheeks and are wanting on its upper brown corner; epistoma comparatively small, somewhat transverse quadrate with rounded angles and with rather distinct roundish lateral pits; cheeks comparatively broad, its pubescence extending below to the jowls where the pubescence is much longer and shaggy, and also extending up a little to the back of the head; back of the head moderately hollowed out, obscured by a greyish tomentum, and bearing some scattered short whitish pubescence; postocular margin with a broad greyish white bare rim, behind which on the middle part of the eye is a single sparse ciliation of black bristly hairs and behind that a more abundant and dense greyish white ciliation which gradually grows a little longer right up to the upper eye-angle, in fact one may sometimes almost say that the postocular ciliation is composed of long and dense greyish white pubescence with a very few sparse bristly black hairs intermixed about the middle part. Proboscis stout and about two-thirds as long as the depth of the head, deep brownish black, covered with abundant and moderately long white hairs behind the stalk; sucker-flaps large, about two-thirds as long as the proboscis, furnished with a few sparse and short blackish pubescence. Palpi short and stout, pale yellowish with the basal joint darker; first joint cylindrical but short, pale yellowish but the outer and lower part of the basal two-thirds distinctly dark grey, covered with numerous long white hairs similar to those on the jowls; second joint evenly pale yellowish, closed with abundant very tiny depressed white pubescence in which two to ten black stronger (still very short) hairs are intermixed about the middle of the outside, but the number of these black hairs is no doubt indefinite as in the European species; second joint bent, blunt-angled and thickened bladder-like on the more horizontal basal third but then bending and narrowing to a fine sharp point, the whole joint being three times as long as its thickest part. Antennae almost evenly dull black, rather short and stout; basal joint slightly obscured with a greyish dust, short, conspicuously

thickened, apically and dorsally produced very cap-like over the second joint, and bearing very short inconspicuous black bristles above and a few short black hairs beneath ; second joint very small and short, about one-thirds as long as the first joint, and the upper part usually concealed beneath the cap-like process of the first joint, pointed cap-like over the base of the third joint, and with a fine sharp dorsal process at the top, and bearing a terminal circlet of short black bristles which are most distinct on the underside ; third joint with the very broad basal annulation and with the very slender style, the former at the broadest part about five-sixth as wide as its length, and the latter about as long as the broad basal annulation ; the dorsal hump obviously angled, but after which the dorsal margin of this annulation is very slightly concave, and with one or two minute inconspicuous black pubescence on the top ; the style-like portion with three basal annulations almost quadrate, but the terminal annulation very long and slender and very slightly shorter than the remaining ones together, this long annulation sometimes being paler and rarely with the top somewhat yellowish and not sharply pointed. Eyes large, in life purplish green at the upper half and somewhat dull metallic green at the lower half, the dividing line straight, narrow and purplish brown, in profile slightly deeper than long, oval, with somewhat straight upper, moderately convex frontal, and strongly downwardly curved lower, margins ; when seen from in front slightly deeper than the width, the frontal and lower angles about 130°, the latter with rounded margin, the upper angle about 100°, and the outer angle evenly rounded.

Thorax subquadrate with rounded angles, slightly longer than the width, greyish black with five faint pale grey stripes of which the middle one is narrowest and is hardly reaching the posterior margin, and the outer two stripes are much distinct, extending below to the posterior-inner ends of the postalar calli and gradually contracting from the suture to the posterior margin but not conspicuously fused together, while the lateral stripes are broadest and extend from the humeri to

the outer-anterior ends of the postalar calli, passing on the praealar calli and the upper wing-basal area; between the lateral stripe and outer median stripe there is an other faint short similarly coloured stripe on each distal part behind the suture, these stripes about as wide as the second stripe and slightly curved outwards, somewhat narrow crescent-shaped, extending from just below the inner angles of the praealar calli to just above the postero-inner ends of the postalar calli; praealar calli usually pale ferrugineous slightly obscured with a greyish tomentum, and postalar calli and upper wing-basal area sometimes brownish; pubescence fairly abundant, usually mainly black except on the front vertical part, nearly erect and fairly long especially after the suture, but on the front vertical part shorter, more depressed, and pale greyish, though the shorter fine and much more depressed greyish hairs may extend more on to the disc or especially on to the sides of the disc and when viewed from front appear to be predominant; on the humeri, on the hind corners of the praealar calli, on the part just above the wing-base, and on the posterior margins of the postalar calli there are distinct whitish tuft of long and dense hairs, while the greyish stripes bear short more conspicuous pale greyish pubescence similar to that on the rest of the disc; scutellum somewhat flat triangular, closed with pale greyish pubescence in which long nearly erect black hairs similar to those on the posterior part of the thorax are intermixed, and bearing a fairly abundant marginal fringe of pale grey hairs. Pleurae obscured with an ashy grey tomentum, covered with dense woolly greyish white pubescence, on the prothorax and on the postero-upper margin of the meso- and meta-pleurae a conspicuous tuft of long whitish hairs.

Wings almost clear or very slightly smoky brownish, with veins yellowish brown to dark brown, but the discal vein and all its division and anal vein blackish, and the costal (or sometimes with subcostal) vein, the apical portion of the radial, the upper branch of the postical fork, and the branches of the cubital fork more or less darker;

posterior cells widely open but the first one sometimes very slightly contracted towards the wing margin; discal cell very large, and distinctly longer than the second posterior cell; anal cell closed a little long before the wing margin; the upper branch of the cubital fork without recurrent veinlet or sometimes with a trace. Squamae glassy greyish or smoky yellowish, with a pale brown or conspicuous dark margin to the alar pair but a pale yellowish grey or paler brown margin to the thoracal pair; fringe very short and pale, but the usual tuft about the angle long conspicuous and greyish white. Halteres brown or dark brown, with the top of the knob usually light yellowish grey or pale brown.

Legs brownish black, with the basal half of the front tibiae and with two pairs of the posterior tibiae pale yellowish or reddish brown or pale yellowish, and with the extreme apices of all the femora and of the middle tarsi (or sometimes hind tarsi also) yellowish brown; front coxae moderately stout and about two-thirds as long as the front femora, densely covered with a ashy grey tomentum and bearing abundant short white pubescence which suddenly grows up considerably longer and much erect at the basal half; front femora with a grey tinge caused by abundant dust, but the bare underside of the front femora conspicuously black and shining and rather distinctly transversely striolate, but not hollowed out through the whole length; pubescence on this femora long and abundant greyish white on the underside with some scattered black hairs intermixed about the apical half, while on the innerside there are very short depressed blackish hairs, and behind the subfemoral bare space there is a rather sparse ciliation of short black bristles; two pairs of the posterior femora greyish dusted as front pair, the middle pair with a conspicuous long whitish pubescence on the outside except for very few black hairs close to the apices, the posterior pair with similar pubescence on the underside and with two or three stout but very short bristly hairs at the extreme apices, and the remaining parts of the both pairs bearing much shorter

depressed similar coloured hairs which become longer about the bases; front tibiae blackish on the apical third or half and yellowish or yellowish brown on the rest, the blackish colour becoming pale yellowish brown or yellowish brown and extending the extreme base or near the base or sometimes only a little distance from the apical blackish part along the underside, the pubescence on the pale portion mainly white but with some longer black hairs towards the dorsal part though scarcely as a fringe, and on the dark portion mainly black and shorter but with some white hairs intermixed about its apical part, while on the dark underside the pubescence almost is very short and black forming a conspicuous fringe which is intermixed with some long white hairs extent from the rest, and on the apical part of the underside there are very few short scattered touch-hairs; pubescence on the middle tibiae mainly whitish, in paler form with a few black hairs on the brownish apical part and with very few scattered stout black hairs on the dorsal margin, but in the darker form black and almost bristly above and apically and on the underside there are some scattered black hairs, the apical spurs unequal and black-tipped; hind tibiae usually darker than the middle pair covered with numerous short white pubescence, and bearing a conspicuous long black outer-dorsal fringe, but in paler form it is very inconspicuous and is composed of a very few short scattered black hairs; all the tarsi blackish, in which the front pair is most darker and bears short scattered touch-hairs beneath, while the posterior pairs have the deep yellow soles. Pulvilli yellow or brownish yellow; claws shining black, but rather brownish about the base.

Abdomen broader than the thorax and distinctly longer than the head and thorax (including the scutellum) together, flat, nearly parallel-sided with the anal apex bluntly rounded. Dorsum blackish, with very narrow yellowish extreme hind- and lateral-margins on each segment except on the basal segment, but this yellowish margins very inconspicuous in the darker form, and with three rows of grey or sometimes

pale yellowish grey spots formed by side rows of distinct small oblong well-defined isolated side flecks and by a middle row of less distinct short triangles on the hind margins of the second to sixth (or sometimes only to fourth) segments; the side flecks on the second and third segments sloping from near the base outwards, and isolated as they by no means extend to the hind margins, and outside the flecks the second segment is indistinctly brown or pale reddish brown to a small or very small extent at the basal corners; on the following three segments the sideflecks less oblique and conspicuous, and gradually becoming smaller towards the posterior segment; the triangles composed the middle row often extending in a thin point up to the foremargin; all the surface covered with a grey tomentum especially on the flecks and hindmargins very dense and sometimes with yellowish one, and clothed with numeous somewhat depressed short black rather bristly pubescence which becomes more erect and longer on the seventh segment, except on the greyish flecks and hindmargins white pubescent, and the middle incised portion of the basal segment and the very small area just below the lateral margins of the scutellum bearing a few rather frizzled white pubescence; the side hairs all blackish and longer but the two basal segments whitish and much numerous. Ventre ashy grey with a shimmering light grey tinge caused by the dense light grey tomentum and the somewhat depressed white pubescence which becomes longer and sloping about the middle through the length; hindmargins of the segments more or less conspicuously and equally pale yellowish; seventh segment with usual long erect though curved black bristly hairs which slightly extend up to the hind border of the just preceding segment.

Length: 13-14 mm.

Male. Resembling the female but darker and more pubescent. Head semicircular, much larger than in the female, its hind margin being less arched and distinctly broader than the thorax. Face moderately puffed up from the eyes, but the epistoma conspicuously sunken from the cheeks behind, densely covered with an ashy grey tomentum,

and clothed with fairly dense fine rather long white hairs as in the female; epistoma very small, somewhat long-triangular with rounded upper angle, while the cheeks are very large and about equal in width through the whole length. Frontal triangle almost in level of the eye-margins, triangular, produced very narrowly above, densely covered with pale yellowish or pale reddish yellow tomentum which becomes blackish above the middle, this blackish tinge forming an indefinite cross-band which is continued with the blackened part of the eyes, while the tomentum on the lower part cross the antennal bases from eye to eye is dark brown, this colour forming a rather conspicuous cross-band and extending a little down the sidemargins of the face. Back of the head with only a very short pale yellowish postocular ciliation behind the much narrow whitish grey or yellowish grey bare postocular rim, which grows a little wider on the upper part especially near the eye-angles, until the upper third of the head, whence a line of long forwardly curved pale yellowish hairs extends to the vertex, and intermixed with them are some similar but black hairs, but behind the vertex there is dense shorter whitish pubescence which more or less interferes into the postocular ciliation, in the darker form the postocular ciliation usually black. Ocellar tubercle very small oblong, not raised from level of the eyes up. Proboscis resting in the groove of the face, stout and very short, dark brown, covered with whitish soft hairs on the stalk and furnished with some scattered thin and curved brown pubescence beneath the sucker-flaps which are about two-thirds as long as the proboscis. Palpi short and about as long as the sucker-flaps, pale yellowish; basal joint cylindrical and as long as the second joint, covered with a greyish tomentum except about its tip and closed with long whitish pubescence; second joint thick oval almost globular, being only one and a third times as long as broad, and thickened apically so as to become rather club-shaped with a very short thick conical tip, and slightly excavated just below that tip; pubescence on the end joint somewhat long, which is intermixed with

black hairs towards the tip. Antennae almost as in the female, but the much paler third joint with its basal annulation comparatively shorter and the style-like portion comparatively longer. Eyes bare, large, touching for about four-fifth front, in profile somewhat triangular with rounded postero-lower angle, deeper than the length; when seen from above triangular with the longest and slightly convex antero-lateral, shortest and straight inner, and almost straight hind margins, the upper angle being 100°; when seen from in front about as deep as wide, the frontal angle about 135°, the upper angle about 105°, the lower angle about 100°, and the outer angle strongly rounded; facets on about the upper-two-thirds almost four times as large as those on about the lower third and with a conspicuous line of separation except that the small facets extend in a rather narrow zone all up the hind-margin of the eyes to the ocellar tubercle; the dividing line across the eyes is hardly undulating but runs nearly straight across the eye to the zone of small facets; in death brownish or dark brown on the space occupied by large facets, and blackish on the rest; in life according to Verrall's description, grey above but green on more than the lower third, with one dark (or rarely purple) band along the top of the small facets, in British form.

Thorax rather darker than in the female and with rather longer much abundant erect blackish pubescence, and with rather longer more conspicuous pale suberect pubescence and less conspicuous whitish pubescence above the wing-bases and along the lower margins of the postalar calli, and with rather yellowish grey stripes. Scutellum with much longer more abundant erect black pubescence, and a few inconspicuous marginal fringe of pale grey hairs. Pleurae darker but obscured with much more abundant more longer and rather shaggy whitish grey hairs.

Wings, squamae, and halteres almost as in the female.

Legs usually more darker, and the blackish or brownish portion of the tibiae much more unwell-defined, and all the tibiae with a less

silvery shimmer especially on the front pair; pubescence longer and darker, there being much more longer black hairs on the two pairs of the posterior tibiae which are forming rather conspicuous black fringes especially on the middle tibiae; pulvilli lighter yellowish.

Abdomen narrower, somewhat conical, about as long as or less than the head and thorax (including the scutellum) together; middle row of spots much less distinct, more shorter and flatter, never extending up to the foremargins; side rows of spots somewhat lunulate and less oblique, and much more separated from the hind margins by a rather distinct blackish intervals; the brownish colouring about the sides of the second segment usually more expanded; pubescence longer, especially on the sides and down the sidemargins, and near the sidemargins of each segment there are conspicuous long black hairs about the middle rather near the hindmargins, especially on the basal two segments more conspicuous; ventre as in the female but the pubescence much longer and more abundant and more erect, especially about the middle part of each segment, the black bristly hairs on the seventh segment more extending up to the preceding segment or sometimes to the fifth segment.

Length: 14-15 mm.

In Japan there is no allied species, but this species in appearance has a resemblance to *Tabanus amaenus*, Walker. However, it is at once distinguished from that by two separated roundish calli on the broad frontal stripe in the female; and by the quite isolated triangles of the middle row on the dorsal abdomen, by less distinct greyish stripes on the thorax, and by the blackish antennae, in the both sexes.

The Japanese materials I possess are rather greyer and smaller than the European form, varying very little in the colour of the third joint of the antennae, which ranges from its normal dull black, though more or less reddish brown its base, to entirely dark reddish brown

with dull yellowish apical annulation, and in the intensity of the cross-band which includes the antennae; other minor variations in the colour of the pubescence, or of the legs or abdomen, are noted in the description, but the variation in the amount of the black bristles on the palpi of the female is remarkable, as it may extend from entire absence to nearly exclusive predominance.

T. cordiger appears to be an uncommon species in Japan, and I have but little knowledge of it. It may occur, however, in the northern and southern parts of Japan, though I only have two actual records from Akita and Kumamoto, where a series of the materials I described have been collected by me. It has been recorded from Europe and North Africa, and is common in South Europe along the Mediterranean to Asia Minor, but northwards it becomes less common though it extends to Finland or England.

I have no actual knowledge of the economic statement of this *Tabanus*, but it may attack horses or cattle, as *Tabanus* do usually.

5. Tabanus fulvimedioides, Shir. (n. sp.) (Pl. V. fig. 8; Pl. X, figs. 6 & 7).

(Kisuji-Abu)

A small blackish species with two rather large shining black or blackish castaneous calli on the nearly parallel-sided rather broad frontal stripe, and with a narrow (but not very so) greyish yellow haired stripe on the blackish abdomen.

Female. Head broader than and nearly a half as long as the thorax, slightly arched behind. Frontal stripe pale yellowish grey or pale yellowish brown, broad, nearly parallel-sided but slightly contracting below and at the vertex, furnished with numerous short variously directed though erect black pubescence which becomes sparse on the lower third or more at where there are some much shorter very inconspicu-

o us yellowish white hairs ; lower frontal callus shining black or dark castaneous, convex, large, subquadrate with the upper half narrower aud with the lower angles roundish but the upper margin irregularily notched, longer than the width, separated from the eye-margins by the very narrow linear intervals and from the upper callus by a broad one but in a rather denuded specimen connected with a narrow line ; upper frontal callus about a half as wide as and slightly longer than the lower callus sharply pointed at the both ends and slightly curved outwards at the sides, dull black, situated on about the middle of the frontal stripe ; vertex somewhat greyer, without the ocelligerous tubercle, covered with abundant short erect black pubescence which becomes slightly longer and sparser behind as it hardly forms a outstanding tuft. Frontal triangle densely covered with a greyish yellow or greyish orange yellow tomentum, moderately raised and touching to the lower frontal callus but there is a very fine though conspicuous transverse linear sulcus between it and the latter, with a fine distinct median sulcus throughout the whole depth, and with orange yellow or deep orange yellow double lunules just above the antennal fossae. Face moderately raised, pale yellowish grey ; epistoma as long as or slightly shorter than wide, with rather narrow lateral pits, bare but bearing some short conspicuous blackish pubescence on about the slightly darkened upper lateral corners ; cheeks rather broad, more or less yellowish brown tinged above and near the eye-margins, covered with numerous but not dense short (but slightly longer than that on the epistoma) blackish pubescence which becomes much sparser towards the inner margin of its lower part ; jowls paler the cheeks, covered with abundant somewhat dense, long, fine, soft, yellowish white pubescence which somewhat extends up to the cheeks at where it becomes shorter, similar pubescence on the lower mouth parts ; back of the head shallow on the lower part but hollowed out above, yellowish grey or paler but greyish yellow or pale brownish yellow above, covered with very sparse fine yellowish white or pale yellowish grey pubescence ; postocular bare

rim moderate in width but rather rapidly narrowed on about the upper fourth or more, yellowish grey or pale brownish yellow, behind which is a dark brown or black ciliation of comparatively long but very dense hairs which become paler towards the jowls, and behind that there is pale yellowish brown or greyish yellow other ciliation which is rather conspicuous more than the blackish one when seen from front. Proboscis moderate in length and thickness, about two-third as long as the depth of the head, blackish, brown, paler towards the base; stalk covered with a yellowish grey tomentum behind, and furnished with numerous rather long erect dark yellow pubescence behind and with some shorter black bristly hairs at the sides; sucker-flaps large and long, longer than the stalk, bearing several scattered short erect blackish brown bristles beneath. Palpi dull pale orange, obscured by a greyish tomentum and black bristles; first joint more or less dark grey with the top quite paler, wholly one-third as long as the second joint and rather narrower, covered with numerous long yellowish white hairs which are very slightly intermixed with a few short black stout pubescence about the top; second joint broadest before the middle and then drooping and gradually contracting to a rounded point, about four times as long as its stoutest part, and clothed with numerous short depessed black bristles all over the upper and outer parts except the extreme base, and with a few thin long pale hairs beneath the basal half. Antennae more or less reddish orange with the basal joints dull pale orange and with the apical annulation of the style-like portion blackish; basal joint short, slightly longer than its thickest part, slightly drawn out cap-like over the small second joint, and covered with dense short black bristles almost all over though no hairs are on the underside except of some slightly longer black apical hairs; second joint wholly a half as long as the first joint, moderately prolonged above over the base of third joint, and with a circlet of short black bristles which become slightly longer beneath; third joint (without the style-like portion) about twice (or less) as long as its broadest part, the dorsal

hump near the base, being well-defined and bearing some tiny black bristles; style-like portion about three-fourth as long as the basal annulation of the third joint, the three basal annulations subquadrate gradually lengthened apically, and the top annulation concial with the rather blunt tip and apparently longer than the preceding one, each annulation bearing one or more very tiny inconspicuous blackish pubescence at the tip.

Eyes bare or sometimes inconspicuously haired and with the facets all practically equal in size, in life metallic green with some shimmer in some lights, with three rather narrow widely separated dark brown bands, of which the middle one is nearly obliquely straight from just above the frontal angle to about the middle of the outer margin, while the lower and upper bands are equidistant from the middle band but not quite so sharply defined at the hind end, rather broader and on the hind quarter converging until they each almost touches the middle line; when seen from above hindmargin about one and a half times longer than the frontal margin and slightly concave, the outer margin slightly but outer quarter strongly convex, the top angle about 100°, and the frontal angle wholly 60°; in profile deeper than long, short irregular oval, the frontal margin slightly convex and the hind and lower margins rather strongly convex, all the angles roundish; when seen from in front broader than it is deep, the facial margin nearly straight and about as long as frontal margin, the frontal angle wholly 125° and the top angle about 90°.

Thorax subquadrate with rounded angles, as long as or slightly longer than it is wide, blackish but quite obscured by a greyish dust. Dorsum covered with greyish yellow or pale yellowish grey tomentum and with numerous though not dense short pale yellowish pubescence intermixed with abundant short erect conspicuous black hairs all over, the anterior border somewhat ashy grey tomentum with five rather broad indistinct grey stripes which only extend to or before the suture; humeri not very conspicuous, covered with somewhat longer yellowish

white soft hairs not intermixed with black ones; praealar calli not very conspicuous, covered with abundant long somewhat curved black pubescence which becomes rather sparser on the upper half at where it is intermixed with short recumbent yellowish hairs; postalar calli haired as on the disc and bearing a long shaggy yellowish white tuft on the postero-outer margin, the similar but shorter and less conspicuous one just above the base of the wing; pleurae much greyer than the thorax, clothed with numerous pale yellowish grey soft pubescence which becomes conspicuously longer towards the sides, and which on the mesopleurae is intermixed with similar but black conspicuous hairs especially on the postero-upper third; prothorax bearing abundant long whitish soft hairs, which at the postero-upper margin of the meso-, ptero-, and meta-pleurae there are long dense pale yellowish grey tufts. Scutellum as the thorax, but the black pubescence longer, and on the margin there is a rather short but not dense and not conspicuous yellowish tuft.

Wings clear but the costal and subcostal cells yellowish, with yellowish brown stigma and with the veins brown or partly yellowish brown, usually as long as the thorax and abdomen together; posterior cells all widely open, the discal cell apparently longer than the first posterior cell, and the anal cell closed before the margin; upper branch of the cubital fork without the recurrent veinlet. Squamae in the alar pair pale grey with a blackish margin and a very short inconspicuous blackish fringe excepting of a dense long yellowish white tuft about the angle, in the thoracal pair pale yellowish grey with a pale brownish yellow margin and an inconspicuous whitish fringe. Halteres yellowish brown, with the knob dark brown, but its top more or less whitish.

Legs black, with the extreme tip of the femora and almost all the tibiae pale reddish brown or dull brownish and with the two posterior pairs of the tarsi dark brown, while the apical half of the front tibiae and all the front tarsi blackish brown; front coxae mode-

rately dilated and about three-fourth as long as the front femora, densely covered with pale yellowish grey tomentum and bearing abundant long pale yellowish white soft pubescence which grows shorter towards the tip at where there is a very few short inconspicuous but stout black pubescence; front femora slightly covered with a pale yellowish grey tomentum leaving a broad shining blackish castaneous subfemoral bare space which is finely transversely striolate and is slightly hollowed out only at the apical part, on the innermargin of this bare space a moderately dense black ciliation of short bristles, pubescence all black and numerous, and with a rarher sparse long black outer-fringe which is inconspicuously intermixed with a very few paler pubescence; two posterior femora more covered with a yellowish grey dust than the front pair, clothed with numerous yellowish pubescence which grows longer on the underside and on about the base of the upperside, and which is inconspicuously intermixed with some black hairs especially on the upper half; front tibiae not dilated but very slightly curved, clothed with numerous short depressed black pubescence but the under half of the pale basal half only with yellowish one, and the touch-hairs somewhat conspicuous on the apical thirds of the under surface; posterior tibiae slightly darkened at the tip, covered with numerous short black pubescence but the under half (except the apical third or more) bearing yellowish one which slightly extends above at the basal half or more, the black pubescence on the upper surface of the hind tibiae forming the not quite conspicuous dorsal fringes, and the spurs of the middle tibiae being rather slender and dull orange yellow with the tip black; tarsi all covered with dense tiny depressed black bristles but the two posterior pair with the reddish brown soles, claws shining black with the base pale, pulvilli pale yellowish brown, and the touch-hairs on the front pair rather long conspicuous, and blackish.

Abdomen slightly broader than the thorax about the base and gradually narrowed to a broad somewhat roundish anal apex, and about

as long as the head and thorax (including the scutellum) together. Dorsum brownish black or dull greenish black, with moderately large reddish yellow-brown lateral spots which extend from the postero-lateral border of the first segment to the anterior border of the third segment but this colouring on the third segment inconspicuous and restricted only to so small space as a dot and that on the second segment wholly occupied on the lateral third or more, with a narrow well-defined continuous yellowish grey tomentose and yellow haired median stripe (from the first segment to the sixth segment) consisting of somewhat triangular spot on each segment, and with the narrow reddish yellow grey tomentose segmentations bearing fine yellow pubescence which almost all is much narrowed about the middle third of each segment; pubescence on the rest all black but on the yellowish (blackish grey on the first segment) sides all yellowish and on the first segment there are some fine inconspicuous pale hairs intermixed. Ventre at the sides black with the narrow pale brownish yellow segmentations, obscured by a greyish yellow tomentum, and covered with fine very short yellowish brown pubescence which in a certain light is yellowish white, the segmentations bearing fine short yellowish ciliation; seventh segment clothed with abundant long erect slightly curved blackish bristly hairs almost all over the surface.

Length: 13.5-14 mm.

Male. Similar to the female, but the thorax is somewhat shining and the median stripe of the abdomen is much more narrower. Head broader than the thorax and almost always larger than in the female, forming a semicircle anteriorly when seen from above with the hind margin nearly straight; face pale yellowish grey with faint some greenish tinge, growing darker on the lower part, bare on quite the middle but with long fairly dense and fine greyish yellow pubescence round the bare part and on the inflated side-cheeks at there are rather abundant blackish conspicuous hairs intermixed, the blackish hairs being

not extend below to the jowls; pubescence at the back of the mouth, and on the jowls longer, paler, and rather shaggy; the bare rim under the eyes greyish white or greyish yellow; back of the head with a very narrow pale bare postocular rim which at the temple region is practically sunk behind the eyes, and behind which is a very short very inconspicuous brownish yellow ciliation which hardly grows longer near the tip angle of the eyes and which has absolutely no long overhanging or outstanding hairs, but in some lights the short ciliation on the temple region is almost whitish and just near the vertex is a few somewhat long brownish hairs; vertex very small, and slightly raised, hardly extending down between the eyes, brownish black or greyish black and clothed with short erect blackish pubescence which is not nearly long enough to constitute a tuft; frontal triangle dull yellow with the greyish brown upper point, and there is a distinct but not well-defined narrow brownish black band interrupted at the middle between the brownish and yellowish parts. Proboscis brownish black, with the rather large sucker-flaps; palpi pale yellow, dusted with whitish, about three-fifth as long as the proboscis; first joint nearly cylindrical and about as the second joint, with a slight blackish grey tinge except at the tip, and clothed with long thin pale yellowish hairs which are intermixed with somewhat stouter blackish about the tip; second joint elongate elliptical, more than twice as long as its thickest part which is a little before its middle, and ending in a rather sudden blunt conical or sometimes evenly rounded tip, and usually with a slight compression beneath just before the tip, widely clothed on its upper part with long soft thin pale yellow pubescence of which there is sometimes some indication on the underside, but the lower half of the outside, sometimes all the underside, and all the tip with numerous not short black stouter hairs. Antennae slightly narrower than in the female; the black bristles on the basal two joints much more conspicuous and longer; the third joint (without the style-like portion) about two and a half or three times longer than deep, the dorsal hump

(near the base) being less strongly defined and usually bearing some tiny black bristles; style-like portion of the third joint about half as long as the basal annulation, and with the short conical black apical articulation. Eyes not quite bare but practically so, as there are only some very short sparse hairs, deep purplish black or bronzy black in death; facets on the larger upper half slightly but distinctly larger than those on the small lower half, and the large facets extend upwards just before the ocellar knob and downwards beyond the junction of the eyes, while the small facets extend in a rather broad zone all round the hind-margin up to the vertex, dividing line being not well-defined.

Thorax moderately shining though it is clothed with a yellowish brown tomentum, and bearing abundant long erect black hairs with no pale ones, but on the humeri, just above the wing-bases and on the prae- and post-alar calli there are some greyish yellow hairs intermixed especially on the latter very conspicuous; scutellum rather small, somewhat triangular, shining, moderately with a yellowish brown tomentum and clothed with abundant long erect black hairs which become much longer along the margin. Pleurae darker than in the female, clothed with numerous rather dense long yellowish grey pubescence which becomes browner about the upper and posterior margins of the mesopleurae, and becomes most yellowish at the postero-upper margin of the metapleure; there are long blackish hairs on the mesopleurae, the blackish hairs abundant and conspicuous about the hind-margin.

Wings, squamae, and halteres as in the female.

Legs with longer pubescence than in the female, especially on the tibiae; the hairs on the hind tibiae forming the fringes on both the dorsal and ventral margins, and on the front femora there is a distinct long blackish fringe at the outer-lower margin.

Abdomen rather small but longer than the head and thorax (including the scutellum) together, rather narrow and with the pointed apex; dorsum very slightly shining, brownish black, with rather distinct

well-defined reddish brown lateral spots similar to the female; median stripe and dull orange yellow segmentations much narrower than in the female; pubescence as in the female, but usually longer and about the sides of all the segments almost black except on the first segment there is some paler one intermixed. Belly much more pubescent than in the female.

Length: 12.3-13 mm.

Described the above from a series of males and females, of which a female from Shinano (July 11th., 1918) is much more yellowish at the abdomen and legs and bears yellowish pubescence on the disc of the thorax.

This species in appearance is very closely allied to *Tabanus fulvimedius*, Walker, but easily distinguished from that, by the quite separated frontal calli on the broader frontal stripe, by the post-ocular bare rim contracting above, by the clear wings, by the narrower abdominal stripe, and by the underside of abdomen all black; there is no other allied species at least in the palaearctic and oriental regions.

At the present time, *T. fulvimedioides* is one of rather common species in the southern parts of Japan, as I have records from Tokio (June), Iyo (June 4th.), Kumamoto (April 20th.), Shinano (July 11th. 1918), Miyazaki (August 4th.), Miyachi (July 2nd.), Shimabara (June 29th.), Fukuoka (July 10th.), and Ichibu (July 3rd.); in the latter district, I collected many females which are resting on the belly of horses near the village of Menda (Kumamoto-Ken), from this fact it may be evident that it is a biting fly.

6. Tabanus quinquecinctus, Ricardo. (Pt. V, fig. 1).

(Itsu-Shiro-obi-Abu).

Supplementa Entomologica, Berlin, III, p. 63, 1914.

Medium-sized (still small) blackish species with white haired scutellum, five white haired bands on the abdomen, thickly white

pubescent tibiae, broad frontal stripe which has two separated calli, and prominent shining black subcallus.

Female. Head prominently broader than the thorax, but very short, and slightly arched. Frontal stripe broad, blackish but entirely obscured by light tomentum which becomes yellowish brown round the upper frontal callus and slightly contracting from the vertex to the eye-angles, about three times as long as its broadest part or four times as long as its narrowest part; pubescence on the frontal stripe rather sparse, very short and blackish, which does not extend at the interval between the frontal calli and just above the subcallus, and which becomes slightly longer and denser towards the vertex; lower frontal callus brown to black shining, transversely quadrate not reaching the eyes only leaving a very narrow greyish tomentose margin, and well remote from the subcallus, very slightly elevated and irregularily longitudinally striolate; upper frontal callus slightly narrower but longer than the first one, blackish but hardly shining, isolated, orbiculate but sometimes cleft downwards and sometimes extending above to a point, widely separated from the lower callus and well away from the eyes, in the middle there is a distinct longitudinal ridge throughout the whole length; subcallus very large and conspicuously prominent, almost all occupied the frontal triangle leaving a very narrow yellowish tomentose double crescent just above the antennae, the median sulcus being very faint; vertex dark grey, parallel-sided, with a very inconspicuous ocelligerous tubercle which is brownish and some times disappears, and with rather abundant long (still short) blackish hairs. Face very broad, with white tomentum and pubescence; cheek rather broad, moderately puffed up, covered with a white dust which becomes greyish brown at the upper corner where the pubescence is blackish brown and shorter, and the pubescence on the rest snowy white, dense, longer, and almost erect; epistoma slightly elevated from the cheeks, with deep lateral pits, covered with denser, long snow-white pubescence which is sloping below and straight; jowls rather flat, thickly covered with longer shag-

gy snowy white hairs which slightly extend up to the back of the head but become rapidly shorter there; postocular margin with a comparatively broad whitish bare rim which is about equal in width about the upper two-thirds but the lower third is narrower and gradually tapering below the jowls, behind this bare rim is a rather sparse blackish ciliation which becomes gradually shorter from the upper eye-angle to the jowls and behind that a more abundant whitish ciliation which gradually grows a little longer though sparser all over the back of the head which is very slightly hollowed out about the upper half; behind the vertex are some conspicuous longer blackish hairs which are slightly lapping over the vertex. Proboscis stout and short, hardly two-thirds as long as the depth of the head, blackish, with dense long white pubescence behind the stalk, and the sucker-flaps much more longer than half the length of the proboscis, furnished with some short blackish bristly hairs below. Palpi slightly shorter than the proboscis, rather stout; first joint brownish, slightly obscured by a greyish tomentum, oval, covered with dense long white hairs which are similar to those on the jowls; second joint on the outside brownish with tip yellowish, but obscured by a whitish tomentum, on the inner side yellowish throughout, the pubescence on the outside short (but about the basal half longer) numerous but not dense, snowy white, and with rather abundant more shorter depressed black bristly hairs intermixed, while on the inner side there is no conspicuous pubescence; this second joint rather stout, and short, broad about the basal half but then drooping and gradually tappering to a point, about three times as long as its broadest part. Antennae rather slender, but about as long as the palpi, tawny or pale reddish brown two basal joints pale yellowish; first joint comparatively large and stout, gradually thickened towards the apex where is broader than the broadest part of the third joint, dorsally pointed very cap-like over the second joint, this process being usually black; the basal joint covered with a whitish grey tomentum, and with numerous black bristles above, while the lower surface

is covered with long erect white pubescence; second joint very small, about one-thirds as long as the basal joint, in colouring similar to the latter, on the apical margin there is a distinct (though small and narrow) dorsal process and a circlet of tiny black bristles which become longer and conspicuous beneath at where there is some long white pubescence intermixed; third joint usually, darker dorsally, rather narrow, the first annulation about twice as long as its broadest part and with the roundish dorsal hump near the base, on this hump there are very few tiny black bristles; the style-like portion of the third joint narrow and conspicuously pointed at the apex, with very faint annulation, more than two-thirds the length of the basal annulation of the segment, with very few tiny hairs especially on the top. Eyes large but rather flat, with inconspicuous fine pubescence, in death deep black with some metallic ruster; in profile about one and a half times as deep as the length, the frontal margin sloping in about 30°, and the lower angle being blunt and rounded but moderately produced below; when seen in front much more wider than the depth, the frontal angle being about 125°, and the upper angle about 80°, and the rounded lower angle about 125°; the facets all about equal in size.

Thorax short, quadrate with rounded angles, blackish with ashy grey tomentum, but the hind border still blackish, pubescence on the disc mainly erect long black, but with some recurrent short white and blackish hairs intermixed, the white one being only distinct about and before the suture, while the blackish one exists on the hind half of the disc, on the front part there are almost only the fine long whitish hairs similar to the erect black pubescence on the disc; humeri moderately conspicuous, ashy grey with long rather shaggy whitish pubescence; praealar calli triangular not very prominent, ashy grey with numerous long shaggy blackish and yellowish hairs intermixed, and on the postero-upper margin there is some shorter whitish pubescence; postalar calli brownish with long black pubescence on the upper half, but the lower half thickly covered with long snowy white hairs which form a promi-

nent tuft; scutellum transverse with rounded posterior angle, entirely obscured by white tomentum, and bearing rather sparse whitish hairs which is intermixed with a few blackish pubescence anteriorily. Pleurae entirely obscured by white tomentum and covered with numerous long shaggy snowy white pubescence which becomes denser above; on the prothorax and metapleurae, and on the postero-upper margin of the mesopleurae there are conspicuous tufts composed of long whitish hairs.

Wings about as long as the thorax and abdomen together, quite clear, with brownish veins of which the mediastinal, subcostal, and postical veins, and the stem of the cubital fork, yellowish; stigma yellowish; all the posterior cells widely open but the fourth cell slightly contracting towards the wing-margin; discal cell large, and longer than the second posterior cell; anal cell closed well before the wing-margin; the upper branch of the cubital fork without any recurrent veinlet. Squamae in the alar pair brown with a blackish margin and a brown ciliation except for the long whitish tuft about the angle; in the thoracal pair pale yellowish with a brownish margin and a rather dense whitish ciliation. Halteres brownish with the knob dark.

Legs blackish, with the extreme tip of all the femora, about the basal two-third of the front tibiae, and the two other pairs of tibiae (except the extreme tips) whitish; front coxae moderately stout, shorter than two-third the front femora, densely covered with a whitish tomentum and bearing numerous long white pubescence; front femora black, very slightly obscured by a greyish tomentum excepting the broad shining bare subfemoral space which is not hollowed out and distinctly transversely striolate, and at the inner margin of this bare space there is a not very dense black ciliation of short bristly hairs; pubescence on the outer side of this femora dense, long, erect black, which becomes to be slope forwards on the dorsal margin, and which extends to the inner side where it is very short and almost all sloping; two pairs of the posterior tibiae more dusted with whitish grey; covered

with rather long white pubescence which becomes shorter above and towards the apex, and which is intermixed with brownish hairs about the base especially on the middle tibiae which bear some long blackish hairs on the underside ; front tibiae slightly incrassate about the apical half, and slightly curved, the underside pale yellowish with very short whitish pubescence, while the remaining part is covered with dense long sloping white pubescence which does not extend on the blackish apical part, where there are very short depressed black bristly hairs, and four or five touch-hairs about the apex of the underside ; middle tibiae almost all covered with numerous long white pubescence which becomes shorter and sloping towards the underside, while the brownish extreme apical part bears very short, sparse, depressed whitish pubescence and two unequal dark brown spurs; hind tibiae covered with rather depressed short white pubescence and bearing longer dense white ciliation (dorsal) and shorter less dense similar coloured ventral ciliation, the brownish extreme apical part pubescent as in the middle tibiae ; all the tarsi deep black or blackish, and with short depressed black pubescence, in which the first pair bears some scattered very long touch-hairs and the two posterior pairs have reddish golden yellow soles ; pulvilli dull yellow.

Abdomen deep black, shining broader than the thorax or head, parallel-sided but the terminal part (fifth to seventh segments) rapidly narrowed as the top has a blunt angle. Dorsum much more shining than the ventre ; first segment with no continuous white haired posterior band but the hind margin covered with ashy grey tomentum and the sides with white hairs nearly the whole width of the segment, the pubescence on the rest dense and black ; every other segment densely covered with black pubescence excepting of the rather broad ashy grey tomentose hind band covered with white hairs, but the seventh segment with no band ; in these white bands the first two are broadest and the others become narrower one behind other, and the first band slightly obscured by some black pubescence; pubescence on the sides is usually

longer than that on the disc, and extreme sides of the second segment whitish and covered with white pubescence and above this part long black lateral tufts exist. Ventre less shining, the same with the exception of the first two segments which are wholly covered with whitish grey tomentum and white pubescence, and of the seventh segment which bears long erect black bristles which slightly extend up to the fifth segment along the middle line.

Length: 11–12 mm.

This small handsome species is easily distinguished from *Tabanus bicinctus*, and the other allied species, by the very thick white pubescent tibiae, by the heavy fringe of black hairs on the femora, and by the five white pubescent bands on the dorsal abdomen.

T. quinquecinctus is only found in the mountainous districts of Formosa, as I have records from Kosempo (May), Arisan (October), and Suisharin (May), and it seems a rather rare species.

According to the late Mr. I. Nitobe, the female is a blood-sucker, attacking the skin of human beings, but the effect of her piercing is not known. The male is still unknown.

7. Tabanus sexcinctus, Ricardo. (Pl. V, fig. 2).

(Mu-Shiro-obi-Abu)

Rec. Ind. Mus., IV, p. 133, 1911; Ann. Hist. Nat. Mus. Nat. Hung., XI, p. 168, 1913.

Small dull blackish species with white bands on the segmentations except the first segment, with white pubescence almost all over the underside of the body, with more or less distinct ocelligerous tubercle, and with whitish tibiae.

Female. Head very short but broader than the thorax, slightly arched. Frontal stripe broad, slightly contracting from the vertex to the front eye-angles, about three times as long as its broadest part or about four and a half times as long as its narrowest part, covered with yellowish grey tomentum which becomes a little brownish round

the upper frontal callus, bearing a few tiny black pubescence which becomes conspicuous and slightly longer about the ashy grey vertex where there is a rather conspicuous dark brown ocelligerous tubercle; lower frontal callus shining blackish, transverse and irregularily square, separated from the subcallus by a rather broad interval which is quite bare from pubescence and from the upper frontal callus by a less broad interval, convex, irregularily furrowed in the middle, not reaching the eyes leaving the narrow tomentose lateral margins; upper frontal callus small, narrow and oblong, black but not well shining; frontal triangle almost wholly occupied by the yellowish shining subcallus leaving a small greyish tomentose upper lateral corner and narrow similarly tomentose rings round the antennal fossae, and the subcallus with a distinct longitudinal median sulcus. Face broad, covered with ashy grey tomentum; epistoma moderately convex, quadrate with rounded angles, bearing abundant but not dense long sloping white pubescence with a very few long black hairs intermixed about the middle; cheeks broad, the upper part about half as wide as the epistoma or the lower part broader than half the width of the latter, the upper corner and the outer margin below to the middle of cheek yellowish and bearing a few brownish pubescence, while the ramaining part bears numerous long white hairs which become longer and denser on the jowls and hardly extend up to the back of the head; postocular bare rim ashy grey, equal in width throughout the whole length, behind that there is a rather dense black ciliation which becomes rather sparser and shorter towards the jowls, and which does not extend on the vertex; the back of the head slightly hollowed out about the upper half, and bearing some fine white pubescence. Proboscis blackish brown, stout, and shorter than the depth of the head, the stalk paler, bearing abundant long whitish hairs behind, the sucker-flaps large and wholly two-thirds the length of the proboscis bearing a few scattered short erect yellowish brown bristles beneath. Palpi stout, yellowish but appearing grey on the outside except the tip; first joint somewhat oval, rather

small, covered with numerous long white pubescence which is similar to that on the jowls; second joint stout about the basal half, and then drooping and gradually diminish to a moderate point, about two and a half times as long as its broadest part; outside of this segment covered with numerous depressed short white pubescence intermixed with very few black bristles which do not extend about the basal third, on the underside of the basal part there are some longer white hairs, the inner side of the second joint bare from pubescence, pale yellowish. Antennae narrow, shorter than the palpi, pale yellow with the third joint pale reddish yellow; first joint dusted with greyish, extending rather cap-like over the short second joint, bearing tiny depressed black bristles above, and some longer (still short) white pubescence beneath near the base, the cap-like process being brownish with dark tip; second joint very small, less than half the length of the first joint, with greyish tomentum, an incomplete circlet of very tiny black bristles and four or five whitish pubescence beneath, and the apical margin with a short process above; third joint very compressed side by side, broad but the style-like portion very narrow and about two-thirds as long as the broadest part of the first annulation, the apical annulation being pointed and dark coloured and with three or four tiny pubescence about the tip; the broad basal annulation of the third joint about one and a half times as long as its broadest part, with a rounded dorsal hump which is almost bare from bristles and situated near the base. Eyes large, rather flat, and somewhat transverse, with sparse very inconspicuous pale pubescence, in death deep purplish black with some metallic ruster; in profile somewhat triangular with rounded angles, apparently deeper than the length, the frontal margin longest and slightly curved, the lower margin next in length and strongly curved below; when seen from in front broader than the width, the frontal angle about 125°, the lower angle roundish and about 130°, the upper angle less than 90°, and the outer angle largely rounded; all the facets practically equal in size.

Thorax black, moderately obscured by ashy greyish tomentum throughout the disc, somewhat oval, gradually brownish towards the posterior border but the sides of disc ashy grey, mainly covered with black pubescence, but with some short recumbent yellowish pubescence about the suture; humeri distinct yellowish but wholly obscured by ashy grey dust, covered with some long whitish and blackish hairs; praealar calli triangular and large, but not well-defined at the antero-upper margin, orange yellow obscured by ashy grey tomentum, bearing numerous long blaskish pubescence with some yellowish hairs intermixed; postalar calli dark brown with yellowish upper margin, wholly covered with ashy grey tomentum, and bearing dense long white pubescence behind and less dense black one on the rest; above the wing-bases there are black pubescence with a very few yellowish hairs intermixed; scutellum somewhat triangular with rounded posterior angle, covered with whitish grey tomentum, and with whitish pubescence which is inconspicuously intermixed with black hairs. Pleurae wholly covered with whitish grey tomentum and long white pubescence; on the prothorax, and on the postero-upper margins of the meso- and meta-pleurae there are white tufts composed of long shaggy hairs.

Wings quite clear, with brown veins which are yellowish about the basal border and of which the subcostal, mediastinal, postical and anal veins and the stem of the cubital fork rather yellowish brown; stigma yellowish; posterior cells widely open, discal cell moderate in size and about as long as the second posterior cell, and anal cell closed well before the wing-margin; upper branch of the cubital fork without any recurrent veinlet. Squamae in the alar pair brownish with darker margin and tiny inconspicuous brownish fringe, excepting of the long whitish tuft about the angle; in the thoracal pair paler and yellowish, with a brownish margin and a less inconspicuous yellowish brown fringe. Halteres dark brown with the stem and the top of the knob yellowish.

Legs blackish but the extreme tip of the femora yellowish and

almost all the tibiae white excepting their apices; all the coxae blackish, obscured by a greyish tomentum, the front pair long, wholly two-thirds as long as the front femora and covered with abundant long, white pubescence which becomes shorter towards the tip; femora blackish but obscured by ashy grey tomentum leaving the rather broad not hollowed transversely striolate shining subfemoral bare space in the front femora; pubescence on the front femora abundant and black but not very dense and conspicuous, at the inner margin of the bare subfemoral space there is comparatively long black ciliation and about the lower margin of the outside there is a long fringe of abundant white hairs; two pairs of the posterior femora covered with thin but somewhat long white hairs which becomes shorter dorsally and apically; front tibiae very slightly incrassate and curved, very pale yellowish white with about the apical fourth black and with the underside pale yellowish brown, covered with rather sparse white pubescence which does not extend on the black portion where there are some black hairs, while the underside is furnished with dense short brownish pubescence and bears two or three moderately long touch-hairs apically; two pairs of the posterior tibiae coloured similarily to the front tibiae, but the apices in much shorter distance paler and the underside more paler, almost wholly covered with abundant rather short and sloping white pubescence, the spurs of the middle pair comparatively long, unequal, dark brown with the tip black; tarsi all black with more or less brownish soles, covered with tiny black bristles, in the front tarsi there are some scattered blackish touch-hairs; pulvilli yellowish brown.

Abdomen shorter than the head and thorax (including the scutellum) together, the basal border slightly broader than the thorax but apparently narrower than the head, and gradually narrowed towards the large blunt anal apex, and moderately flattened. Dorsum blackish but obscured by brown tomentum, except the posterior margin of each segment, covered with ashy grey tomentum, and the first two

segments with the sides ashy grey; pubescence on the disc abundant, rather short black, but the posterior ashy grey bands (except that on the basal segment) and the similar coloured sides of the two basal segments furnished with conspicuous white pubescence which becomes sparser on the posterior two bands; these white bands diminish their width one after one; the seventh segment with some conspicuous long sloping black bristly hairs. Ventre blackish, but almost wholly covered with ashy grey tomentum and tiny white pubescence, except on the bases of three posterior segments brown dusted and black haired; the seventh segment with abundant long erect but curved black bristles which slightly extend up to the fifth segment along the median border.

Length: 9.5 mm.

Except for this very slight difference, that the eyes are not conspicuously pubescent, this species is identical with *Therioplectes subcallosus*, Ricardo, described in the Records of the Indian Museum, Vol. IV, p. 227, 1911. The latter species sometimes has very scarce and very inconspicuous pubescence on the eyes, and this form may be the same as *Tabanus sexcinctus*. In the British Museum, I compared one specimen from Kumaon; India, arranged by Miss Ricardo in a drawer as *sexcinctus*, with the specimens of *Th. subcallosus*, which are also indentified by the same student, but I have not found any valid differences between them.

At the present time, however, I hesitate to determine that *Th. subcallosus* is a synonym of *sexcinctus*, because I have not examined the type of Ricardo.

T. sexcinctus is distinguished from the allied species belonging to the Group II of Ricardo, by six white bands on the abdomen, hy much more ashy grey thorax, by more distinct ocelligerous tubercle, and by more distinct pubescence on the eyes.

I posses only one female from Rano (May) in southern Formosa, from which the above is described. It is noticed that the species occur in India, Burma, and Formosa, but this may be rather a rare

species in any countries where it occurs, and most certainly in Formosa. The economic side of this fly is not known yet, and the male is unknown to us.

8. **Tabanus bicinctus,** Ricardo. (Pl. V, fig. 3).

(Futa-shiro-obi-Abu)

Rec. Ind. Mus. IV, p. 132, pl. XIII, fig. 5, 1911; Suppl. Ent. III, p. 64, 1914.

A small handsome black species with a broad ashy grey band occupied the anterior half of the thorax, white-haired scutellum and postalar calli, and white-haired bands on the third and fourth segments, whitish tibiae, wings tinged brown on the fore border, and two-separated black frontal calli.

Female. Head much broader than the thorax, rather short and slightly arched. Frontal stripe black, obscured by dark yellowish brown tomentum which becomes ashy grey about the intervals between the two frontal calli and between the frontal triangle and lower frontal callus, narrow, distinctly contracting from the vertex to the frontal eye-angles, and wholly seven times as long as its narrowest part or wholly five times as long as its broadest part; pubescence on the frontal stripe rather conspicuous black, directed upwards on the upper part, while at the lateral margin about the middle part the pubescence is similarly coloured but slightly shorter and sloping below, which becomes inconspicuous and white on the whitish part except on the portion just above the subcallus; lower frontal callus shining black, irregularly square, slightly longer than the width, separated from the subcallus by a narrow ashy grey interval, slightly convex, with a median longitudinal furrow, almost reaching the eyes; upper frontal callus black but not very shining, oblong, narrow, and about half as wide as the lower callus, furrowed in the middle; frontal triangle prominent, almost wholly occupied by the dark brown shining subcallus leaving a very narrow yellowish grey tomentose double crescent just

above the antennal fossae, and in the middle there is a distinct but fine longitudinal sulcus throughout the whole length of the frontal triangle; vertex dark brown, with a very faint brown ocelligerous tubercle, and covered with short but stout erect black pubescence; behind the vertex there is some longer black pubescence. Face moderately convex, covered with a whitish tomentum, and with long white hairs; epistoma slightly shorter than wide, with rather small lateral pits, the pubescence being straight and directed downwards; cheeks much more white than the epistoma but the upper corner dusted with dark yellowish brown, the pubescence rather shorter and not straight, which becomes dark brown on the brown upper corner, and which grows longer and shaggier about the jowls, but hardly extends up to the back of the head; the ashy grey postocular bare rim very narrow and about equal in width throughout the whole length but very inconspicuously broadened towards the jowls, behind this rim there is a short blackish ciliation which becomes sparse and paler to white about the outer eye-angle, and which does not enter into the vertex or occiput; the back of the head very slightly concave, dusted with ashy grey and covered with some paler pubescence. Proboscis rather stout, shorter than the depth of the head, blackish brown, bearing some long erect black pubescence behind the stalk, the sucker-flaps large, about three-fourths as long as the proboscis, much darker and furnished with a few short black bristles below. Palpi slender, not reaching the top of the proboscis, dark grey; first joint globular, covered with long white pubescence which becomes shorter towards the upper part, and with a few scattered rather short black bristly hairs intermixed about the apical part; second joint yellowish but obscured by dark grey tomentum on the outside but the inner side almost bare from the dust, long though thickened for nearly the basal half, but tapering gradually after that to a rather blunt point, rather drooping, wholly two and a half times as long as its broadest part; the pubescence on this joint very short, somewhat dense, depressed

and black, but near the base there is some longer whitish hairs beneath. Antennae reddish yellow, slightly obscured by a greyish tomentum; first joint cylindrical and moderately thickened towards the tip, extended like a hood over the second joint, and bearing on all its upper side dense short black bristles, whole on its underside are no longer pale hairs; second joint very short, about one third as long as the basal joint, with an apical circlet of black bristles which are very short on the upper side but slightly longer on the underside, and with a distinct spine-like apical process above; third joint less than three times as long as two basal joints together, the basal annulation not very broad but rather slender, near the base with very small tooth crowned with a few black hairs; style-like portion of the third joint short and about half as long as the basal articulation, with the short conical apical annulation. Eyes rather large, bare, in death deep purplish black with some metallic ruster; in profile shorter than the depth, with moderately curved frontal margin and with evenly rounded remaining margins; when seen from front slightly broader than the depth, the frontal angle about 120°, the outer angle strongly but evenly curved outwards, the lower angle about 135° but rounded, and the upper angle about 90° with the slightly curved upper margin.

Thorax short and stout, broadest about the middle and gradually narrowed forwards and slightly hindwards, black, obscured by an ashy grey tomentum on the anterior half or third and with brownish black dust on the posterior half; pubescence on the whitish broad band mainly white but there are some dark hairs about the anterior vertical part, on the blackish broad band stouter and black; humeri distinct dusted with ashy grey and covered with some long pale hairs; praealar calli yellowish brown, wholly obscured by a whitish grey dust and furnished with abundant long yellowish white pubescence which is somewhat intermixed with stout black bristles especially about the posterior angle there are black bristles only; postalar calli moderately distinct, almost wholly covered with whitish grey tomentum,

which are connected by a narrow ashy grey tomentose posterior margin of the disc with one another so that the posterior border of the thorax has a somewhat distinct whitish band, the pubescence on the postalar calli mainly black but on the outer margin there is a distinct white tuft composed of very dense rather long hairs straightly directed behind; scutellum large but rather short, dusted with whitish grey and covered with dense white or pale orange yellow pubescence. Pleurae evenly obscured by ashy grey tomentum, and covered with long white pubescence, and on the prothorax and on the postero-upper borders of mesopleurae and of metapleurae there is a distinct dense white tuft.

Wings apparently longer than the thorax and abdomen together, hyaline but distinctly obscured by brownish tinge especially on the apical fore border as far as the upper branch of the cubital fork, with veins and stigma dark brown; all the posterior cells widely open, discal cell comparatively narrow but longer than the second posterior cell, and anal cell closed a little before the wing-margin; upper branch of the cubital fork with a distinct recurrent veinlet (in some specimen wanted). Squame in the alar pair yellowish ashy grey with black margin and short black fringe, in the thoracal pair brown with darker margin and brownish fringe; the tuft on the angle between the alar and thoracal pairs long and blackish brown. Halteres brown with darker knob which has paler apex.

Legs black, with tibiae white but black at the apices and with the extreme apex of the femora yellowish; front coxae stout, about two-thirds as long as the front femora, obscured by ashy grey tomentum, and covered with this white puebscence which becomes shorter towards the apice; front femora slightly obscured by greyish tomentum leaving the broad convex finely transversely striolate shining bare subfemoral space, inner margin of the bare space with a very short black ciliation; pubescence on the outer side of the front femora long, rather dense and blackish, on the innerside much shorter but

much denser and sloping; middle femora slightly obscured by a grey tomentum, and bearing rather short dense black pubescence which is intermixed with some short whitish hairs about the outer basal half; hind femora also slightly obscured by a grey tomentum, and bearing short rather thick black pubescence which becomes much longer and white on the underside especially about the basal two-thirds; front tibiae about the apical fourth black, the colour narrowly extending near the base along the underside, pubescence on the white part somewhat long, thin, sloping, and white, with very few very scattered black hairs intermixed about the middle two-fifths, on the black apical part wholly black, and on the dark under side there is a dense very short fringe of sloping black hairs which become paler towards the base; two pairs of the posterior tibiae with the about apical sixth blackish brown, the pubescence being short and white with a very few (less than 10) black hairs intermixed, but on the blackish apices all black; the apical spurs of the middle tibiae brownish black and unequal; all the tarsi black but the posterior two pairs not deeper, covered with tiny black bristles, the touch-hairs on the front tarsi rather numerous but scattered, and which extend up to the under apical part of the front tibiae; pulvilli yellowish brown, and claws blackish.

Abdomen wider than the thorax and about as broad as the head, and about as long as the head and thorax (including the scutellum) together, nearly parallel-sided but about the junction of two basal segments slightly broader and three apical segments forming a blunt angle posteriorily. Dorsum slightly shining black and slightly covered with a brown tomentum, and with short dense depressed black pubescence which becomes white on the whitish grey bands and the first segment on the sides there is a large whitish grey dusted and white-haired lateral marking; the second segment largest, with ashy grey tomentose and white pubescent extreme lateral margin and with an inconspicuous small similarily dusted dot on the middle near the hind

margin; the two followings with whitish grey tomentose bands on the broad (but still narrow) hind margins, these bands becoming broader in the middle above and bearing white or very pale orange pubescence; the last three segments with the very narrow greyish white hind marginal bands; pubescence on the sides slightly longer than on the disc. Ventre black, similarly dusted and haired as in the dorsum but less shining and the two basal segments wholly dusted with whitish grey, while the whitish bands are broader and never swollen about the middle, and the seventh segment without whitish bands but with some stout long erect black bristles which hardly extend up to the preceding segment.

Length: 9.5–10 mm.

Described from six females (well preserved), one from Rono (March) in the southern part of Formosa, and others from Naniwa (July 25th.) of Giran District in the northern part of the same. The specimen from Rono is much more identical with the type than the species noted by Miss Ricardo in the Supplementa Entomologica, No. III, p. 64, 1914, and quite the same as a number of specimens found in the Federate Malay States.

This handsome species probably varies rather greatly in the number of white bands on the abdomen (from two to five), and in the colouring of the subcallus (from reddish yellow to dark brown); but it is distinguished from the preceding allied species, by the narrow frontal stripe, by the brownish wings, by the two distinct broad white abdominal bands, by the rather shorter pubescence on the legs, by the dark palpi, and by the two differently coloured thorax.

A female rested on my left arm and pierced it about two o'clock in the afternoon. In this case her piercing was rather severe, but the effect did not continue for wholly a day.

9. **Tabanus fulvicinctus,** Ricardo. (Pl. IV, fig. 8).

(Koshi-aka-Hime-Abu)

Suppl. Ent., III, p. 62, 1914.

Rather small dark species with slightly ashy white scutellum, with white-haired tibiae and femora, and with shining dull yellowish subcallus, and with two separated frontal calli.

Female. Head very short but broad, apparently wider than the thorax, slightly arched. Frontal stripe yellowish grey, slightly contracting from just below the vertex to the front eye-angles, about five or six times as long as its narrowest part or about three or four times as long as its broadest part, the side margins not straight but slightly curved outwards so that the frontal stripe is equal in width through the vertical part; lower frontal callus blackish brown, shining, almost square but sometimes long, moderately prominent and not reaching the eyes; upper frontal callus longer than the first one but very narrow like a streak, sometimes about as long as the first one and long spot-like, black and shining, very slightly elevated; pubescence on the frontal stripe very inconspicuous, rather few, mostly sloping below and partly erect, on the space between the lower frontal callus and subcallus there is no pubescence; vertex slightly ashy grey; with a few scattered short though longer than that on the frons black pubescence and with an inconspicuous small oval brown ocelligerous tubercle; subcallus shining dull yellow, large, moderately prominent, reaching the eye-margins but not extend to the antennal fossae leaving a narrow greyish yellow tomentose double crescent, in the middle there is a very fine longitudinal sulcus through the whole depth. Face whitish but the upper extreme more or less yellowish grey especially at the upper corner of the cheeks; epistoma moderate in size, quadrate with rounded angles, moderately convex, covered with numerous long snowy white hairs; cheeks rather broad, with similar white pubescence intermixed with stout though short blackish brown hairs which become numerous towards the upper and eye-marginal parts where the white

hairs almost disappear; jowls moderately puffed out below the eye, covered with numerous long snowy-white hairs which extend slightly up to the back of the head which is slightly hollowed out and ashy grey; back of the eyes with a narrow bare whitish postocular rim, which is about equal in width throughout its length, but widens a little when quite close to the upper eye-angles and contracts at the enter of jowl, and behind that with a short (though comparatively long) stubby ciliation which is paler and shorter still below but which becomes black right up to but not beyond the upper eye-angles, behind the vertex are some longer black hairs. Proboscis short and stout, about two-thirds as long as the depth of the head, blackish brown; the stalk with abundant long erect yellowish pubescence intermixed with stout blackish bristly hairs; the sucker-flaps large, darker, about two-thirds as long as whole the length of the proboscis, furnished with a few scattered short blackish bristles below. Palpi light whitish yellow, stout, about as long as the proboscis; basal joint brownish grey, oval, densely covered with long snowy white pubescence similar to that on the jowls; second joint slightly darker outwards, long though thickened for nearly the basal half but tapering gradually after that to a point, rather rooping and about two and a half times as long as its thickest part, bearing numerous though not dense short depressed black bristles all over the upper and outer side, but sometimes with these black bristles less numerous on about the basal third, and with a few shining white hairs intermixed, and this second joint bears beneath about its base some longer snowy white pubescence, but is bare on its inner side. Antennae slender but about as long as the palpi, yellow ochre; basal joint short and stout, extending dorsally moderately cap-like over the second, covered with whitish tomentum and numerous black bristles which do not extend below to the underside where there is a few pale hairs; second joint very small, about half as long as the basal joint, with a narrow spine-like tiny process at the dorsal apex, and with a somewhat complete circlet of

tiny black bristles round the tip; third joint narrow, about two and a half times as long as two basal joints together, and more than four times as long as its broadest part, very slightly darker at the dorsal margin; first annulation of the third joint, rather narrow, about two and a half times as long as its broadest part, with a very small flat dorsal hump which is not pointed but rather rounded and bears two or three tiny black bristles; the style-like portion distinctly four jointed, rather long, about two-thirds as long as the broad first annulation of the third joint, gradually tapering to a point, and bearing two or three tiny hairs on each annulation. Eyes rather large but rather compressed from front to back; in profile apparently shorter than the depth, the frontal margin comparatively long, moderately sloping from the vertex to the frontal angle, the lower angle very flat and rounded; when seen from front wider than the depth, the frontal angle situated below two-thirds from the vertex and about 130°; in death deep black with irregular metallic ruster but without any markings or bands; all the facets practically equal in size.

Thorax moderate in size, quadrate with rounded angles, blackish covered with pale grey tomentum which becomes paler on the anterior and lateral borders; pubescence on the disc rather dense, recumbent, orange yellow, with abundant long erect black hairs intermixed; humeri rather large, reddish brown or yellowish brown, covered with ashy grey tomentum and with adundant somewhat long yellowish pubescence which is intermixed with some short black hairs; praealar calli triangular, with rounded posterior angle, moderately prominent, dark reddish brown but obscured by an ashy grey tometum, bearing abundant long erect black hairs intermixed with short orange yellow pubescence which is similar to that on the disc but slightly longer; postalar calli rather large but not prominent, this callus above the base of the wing reddish brown obscured by a greyish tomentum, and with erect though slightly curved black hairs and a short yellowish pubescence intermixed; scutellum large, transversely elongated

quadrate with blunt rounded posterior angle, the lateral margins being almost straight with acute post-lateral angles, black but entirely obscured by an ashy grey tomentum, and covered with an abundant short orange yellow pubescence and numerous long erect black hairs. Pleurae blackish; covered with an ashy grey tomentum, bearing an abundant long soft white pubescence which becomes much numerous above, on the prothorax, and on the upper-hind parts of the meso- and meta-pleurae there is a distinct shaggy tuft composed of long pale yellowish hairs which have quite white tops.

Wings clear though slightly brownish, about as long as the thorax and abdomen together, with yellowish veins though their posterior parts mostly brownish; costal cell yellowish, and stigma yellowish brown; posterior cells all widely open, and discal cell rather large, longer than the second posterior cell; anal cell closed before the wing-margin; upper branch of the cubital fork with a very short or sometimes long recurrent veinlet. Squamae in the alar pair brown with a dark margin and a short brownish fringe excepting for the angle at where there is a long yellowish tuft; in the thoracal pair prominently large, yellowish brown, with a brownish margin and an inconspicuous yellowish fringe. Halteres reddish brown with yellowish stalk.

Legs blackish with the basal two-thirds of the front tibiae and the basal four-fifths of the middle and hind tibiae pale yellow; front coxae long and about two-thirds as long as the front femora, black but obscured by a greyish dust, and covered with numerous long white hairs; front femora black (excepting of the extreme tip yellowish), obscured by ashy grey or greyish tomentum leaving a rather broad shining bare subfemoral space which is not hollowed out and indistinctly striolate transversely, furnished with a numerous long white pubescence intermixed with some similar but black hairs, on the inner margin of the bare underside there is a numerous but not dense short black fringe; two pairs of the posterior femora blackish, with the tip yellow-

ish; covered with an ashy grey or greyish tomentum and with moderately long though shorter than that on the front femora white pubescence on the hind femora with rather distinct long white ventral fringe; front tibiae curved and slightly incrassate, bearing numerous short sloping black pubescence which becomes sparse about the white basal two-thirds where there are numerous similar white hairs intermixed; middle tibiae about the apical fourth with numerous short sloping blackish brown pubescence and the rest part with the similar but white pubescence, while the blackish one extends up to near the base along the dorsal margin; hind tibiae covered with similar white pubescence, leaving the apical fifth and the dorsal margin where there is numerous somewhat longer black pubescence; front tarsi deep black, with brownish soles, and with some long scattered brownish touch-hairs which slightly extend up to the extreme top of the front tibiae; two-pairs of the posterior tarsi blackish, with reddish brown soles; pulvilii dull orange yellow, and claws deep black.

Abdomen very slightly broader than the thorax and much longer than the head and thorax (including the scutellum) together, with the rounded apex. Dorsum brownish black, but lighter coloured on the first three segments of which the second and third segments have large very faintly defined (or seldom reddish) lateral spots; pubescence on the disc rather short and dense, golden yellow, intermixed with rather abundant black hairs which do not appear on the very faint hind marginal bands, the black hairs becoming longer and much numerous towards the terminal segment and at the sides except the sides of three basal segments where there is a short white pubescence. Ventre paler with darker tip, and covered with ashy grey tomentum with short yellowish white pubescence; on the seventh segment there are long erect black bristly hairs, and on the sixth segment there are sloping long (though shorter than those on the second) black hairs which slightly extend up to the fourth (or sometimes third) segment along the middle line.

Length : 10-12 mm.

This species is not uncommon in mountainous districts throughout Formosa Island, as I have records from Tentana, Taipin, Rukio, Sokutsu, Horisha, Kosempo, and Mt. Rito, from July to September, but it may be rather rare in the plain districts, only one having been collected by H. Sauter at Hozan ; while the male is not captured yet by any collecters. The female is known as a blood-sucker attacking human beings, according to the late Dr. T. Kawakami's observation.

10. Tabanus iyoensis, Shir. (n. sp.) (Pl. V, fig. 4 ; Pl. X, figs. 8 & 9).
(Iyo-Shiro-obi-Abu).

Medium sized blackish brown species with yellowish shining subcallus, two black separated frontal calli, white-haired scutellum, five whitish yellow haired abdominal bands of which two are very distinct and broader, and whitish tibiae.

Female. Head large, slightly broader than the thorax, and very slightly arched. Frontal stripe covered with ashy grey tomentum which becomes slightly yellowish about the middle and slightly darker above, rather narrow, slightly narrowed towards the frontal eye-angles, but about equal in width through the vertical portion, and wholly seven times as long as its narrowest part or four times as long as its broadest part (between the vertex and upper frontal callus) ; pubescence on the frontal stripe mostly black and rather conspicuous, but on the lower portion (below the upper frontal callus) there are some rather inconspicuous yellowish white hairs, the black pubescence being rather denser and much conspicuous towards the vertex ; lower frontal callus blackish brown and shining but slightly yollowish below subquadrate and slightly longitudinally elongate, or rarely transversely, with rather straight lower margin but the upper margin laterally produced above, separated from the subcallus by a narrow yellowish grey tomentose interval, slightly convex and very often with an indistinct longitudinal median sulcus ; isolated upper frontal callus very narrow but as long as

or shorter than the lower one, sharply pointed at the upper and lower ends, very slightly elevated and longitudinally striolate, black but less shining. Vertex dark but whitish grey behind, with numerous short black pubescence and with a very inconspicuous brownish ocelligerous tubercle which is sometimes wanted; frontal triangle rather slightly convex and comparatively narrow, almost wholly occupied by yellowish shining subcallus leaving a narrow yellowish grey tomentose double crescent just above the antennal fossae, the subcallus with a distinct though very narrow and shallow longitudinal median sulcus through the whole height. Face moderately convex as usual, covered with whitish grey tomentum and white hairs; epistoma large, quadrate with rounded angles, as long as wide, with the rather small lateral pits, covered with numerous long (but not very long) straight sloping white pubescence which becomes slightly shorter above; cheeks comparatively narrow and the width in the broadest part less than the half of the epistoma, the upper corner wholly covered with yellowish or brownish grey tomentum which extends below to the middle part along the eye-margin where there is almost only brown pubescence and the rest of the cheeks covered with rather short white pubescence which grows up longer about the jowls, and which hardly extends up to the back of the head; the back of the head covered with an ashy grey tomentum and with some scattered short white pubescence, very shallow on the lower part but distinctly (though not deep) hollowed out on the upper part; the postocular whitish bare rim rather broad and about equal in width through the whole length but widened below near the jowls, and behind this bare rim there is a black ciliation of rather long but not very dense hairs which becomes slightly shorter and paler below, and which disappears on the jowls and does not extend on the vertex behind which is some long black pubescence. Proboscis stout and wholly two-thirds as long as the depth of the head, blackish brown, slightly dusted with greyish, the stalk on the hind numerous long white pubescence similar to that on the jowls, the sucker-flaps darker,

large, wholly two-thirds as long as the length of proboscis, and furnished with some scattered shorter blackish bristly hairs. Palpi slender but not reaching the end of the proboscis, pale yellow and obscured by greyish tomentum; basal joint globular, covered with dark grey tomentum and numerous long shaggy white pubescence similar to that on the prothorax; second joint slender but stout about the basal half and then drooping and gradually narrowed to a point, and about two and a half times as long as its broadest part, covered with dark greyish tomentum on the outside but the top still yellowish, and bearing numerous but not dense short depressed black bristly hairs with similar white pubescence intermixed, the white pubescence being longer about the base especially on the outer-lower side. Antennae pale orange yellow, with the upper side dark, shorter than the palpi; basal joint pale yellow, slightly dusted with greyish, short and cylindrical and slightly thickened apically, slightly produced at the upper tip, covered with short dense black bristles which become much shorter, sparser and inconspicuous on the underside, where there are some longer whitish hairs, and about the upper base with a very few short yellowish pubescence intermixed (this may be not constant character); second joint small shorter than the half of the basal joint, similarly covered with basal joint, with a rather long spine-like process on the upper apical margin, and about the top with a complete black circlet of comparatively long bristles which become much longer on the underside; third joint about three times as long as its broadest part, slightly reddish and slightly darkened apically especially in the style-like portion, the basal annulation nearly twice as long as its broadest part where it has a very small tooth crowned with very few black bristles, this dorsal hump being near the base; the style-like portion of the third joint wholly two-thirds as long as the stout basal annulation of this joint, with long shaggy pointed apical annulation which is about twice as long as the other annulations and bears two or three tiny black pubescence at the top, the rest annulations also bearing two or three

inconspicuous tiny pubescence near the apical margins. Eyes moderate in size, with a scattered very inconspicuous pale pubescence but practically bare, in death deep purplish black with some metallic ruster and without any markings or bands; in profile about three-fourth as long as its depth, the frontal margin longest and moderately curved forwards, the rest margin evenly but strongly curved backwards with rounded frontal angle; when seen from in front apparently higher than its width, the frontal angle wholly 135°, the lower angle about 120° with rounded angle, the upper angle about 90°, and the outer angle evenly rounded; all the facets practically equal in size.

Thorax short and rounded, about three tomes as long as the head, blackish but covered with brown tomentum, which becomes ashy grey on the anterior border especially on the vertical portion, bearing short recumbent yellowish pubescence with numerous erect black hairs intermixed all over the surface; humeri distinct, covered with ashy grey tomentum and some long whitish hairs; praealar calli conspicuous, somewhat triangular, covered with ashy grey tomentum, and bearing long rather scattered pale yellowish pubescence all over the surface and some shorter rather dense black bristly hairs at the posterior-lower margin where there are also similar but yellow ones intermixed; postalar calli rather narrow and long, moderately elevated, covered with dark ashy grey tomentum and black pubescence which becomes yellowish about the inner end, but on the posterior margin there is a conspicuous long white tuft; the black pubescence on the disc becoming longer towards the margins, and paler about the suture just above the anterior stigma and on the greyish vertical portion, while the yellowish pubescence becomes much conspicuous and longer about the suture just above the praealar calli and just front the postalar calli; scutellum broad, transversely elongate, with blunt roundish posterior angle, very conspicuously dusted with whitish grey, and bearing numerous long pale yellowish hairs (not quite white). Pleurae covered with ashy grey tomentum, and with numerous white pubescence

which becomes slightly longer and much denser above; on the prothorax and metapleurae, and on the postero-upper margin of the mesopleurae there are distinct white tufts composed of rather shaggy long hairs.

Wings a little shorter than body, nearly quite clear, with pale brownish veins of which the mediastinal and radial veins, and stem of the cubital fork, conspicuously yellowish, and with yellowish brown stigma; posterior cells all widely open, discal cell moderately wide and shorter than the second posterior cell, and anal cell closed somewhat long distance from the wing-margin; the upper branch of the cubital fork without the recurrent vienlet, but sometimes with the distinct one; mediastinal vein furnished with a row of very tiny black spines, and the subcostal vein covered with numerous dense similar spines. Squamae in the alar pair greyish with a blackish margin and a tiny black ciliation except the long whitish tuft about the angle; in thoracal pair brownish with a brown margin and a very fine whitish ciliation. Halteres slender, yellowish brown, and with dark knob.

Legs rather narrow, blackish, with the extreme apices of the femora yellowish, and with the about basal half of the front tibiae and with two pairs of the posterior tibiae (except for the extreme tips brown) pale yellowish white; the front coxae very stout and wholly two-thirds as long as the front femora, black obscured by an ashy grey tomentum and covered with numerous rather dense long white pubescence which becomes shorter and sparser apically; the front femora brownish black, slightly covered with a greyish tomentum but slightly shining, and bearing numerous but not much dense very long blackish pubescence which becomes considerably shorter on the inner side, on the underside the narrow transversely striolate shining bare space not hollowed out excepting on the extreme apex, and on the inner margin of this subfemoral space there is a comparatively long (still very short) blackish ciliation of bristly hairs; two pairs of the posterior femora rather reddish brown to blackish, more covered with

ashy grey dust than the front pair, and bearing shorter but white pubescence which becomes longer on the underside; front tibiae very slightly incrassate, and slightly curved, pubescence all stout, depressed and rather dense, which is black on the black portion and is slightly longer and white on the rest, and pubescence on the pale yellowish brown underside mainly pale but with some black hairs intermixed, and the black pubescence on the outerside very sparsely extending up to the basal half; two pairs of the posterior tibiae covered with rather short rather dense white pubescence which becomes black and much shorter on the apical brownish portion; tarsi all black or brownish black, covered with dense short black pubescence, in the front pair with a few scattered long and thin touch-hairs which somewhat extend up to the apical portion of the tibiae, and in the posterior two pairs with very dark reddish brown soles; pulvilli dull yellowish, and claws brown with the tips deep black.

Abdomen longer than the head and thorax (including the scutellum) together, broadest near the base and gradually but slightly narrowed to a large rounded apex. Dorsum black and slightly shining; first segment with the large ashy grey tomentose lateral markings which occupy the whole sides and their hind margins slightly extend inwards; second segment on the hindmargin more or less dusted with ashy grey, and the sides distinctly covered with an ashy grey tomentum; the following two segments each with a distinct broad ashy grey tomentose hind marginal band, and their sides not dusted with greyish; fifth and sixth segments narrowly dusted with ashy grey on the hind margins, the whitish band on the first segment being broader and more distinct than that on the following one; terminal segment on the extreme hind margin with very narrow greyish dusted band, while the bands on the third, fourth, and fifth segments more or less broadened anteriorily somewhat triangularly about the middle; pubescence on the dorsum mainly black and comparatively long and sloping, but on the whitish bands pale yellowish white and rather depressed,

while the greyish hind margins of the second and seventh segments are not furnished with any pale hairs excepting on the extreme margins and on the seventh segment there are numerous long black bristly hairs ; pubescence on the sides somewhat longer and black but on the two basal segments yellowish white. Ventre blackish brown and more greyish, covered with ashy grey tomentum which becomes thinner toward the anal apex, but the extreme hind margin of each segment more or less distinctly dusted with ashy grey ; pubescence numerous and depressed, pale yellowish white on brownish parts and white on ashy grey parts especially on the hind margins, but on the seventh segment there ere abundant erect long black bristly hairs and on the two preceding segments some long sloping stout black pubescence.

Length : 10.5–12 mm.

This species is allied to *Tabanus sexcinctus*, Ricardo, but distinguished from that, by its less broader head with a very narrow frontal stripe which has an elongated lower frontal callus, by much browner thorax with less whitish legs of which the frontal femora bear only black pubescence, and by pale yellowish pubescent abdominal bands, which are conspicuous only on the third, fourth, and fifth segments, and these three are triangularly broadened in the middle ; and also allied to *Tabanus fulvicinctus*, Ricardo, but easily distinguished by the whitish bands on the abdomen which are not paler or reddish brown about the base, by the colouring and comparative length of the pubescence on the front legs, and by the form of the dorsal hump of the antennae.

In only one case I met, the female bit the cattle free in pasture in early Summer, but it is now unknown, whether the fly bites human beings or not.

T. iyoensis may be rather common in Kiushu and Shikoku as I have records from Sasayama, Futsukaichi, and Kumamoto, from July to August 30th , but never found in the northern parts of Japan proper,

neither in Hokkaido, Sakhalin, nor also in Formosa and Riukiu Islands.

11. Tabanus humilis, Coquillett. (Pl. V, fig. 5; Pl. X, figs. 10 & 11).

(Ao-Ko-Abu).

Proc. U. S. Nat. Mus., XXI, p. 311, 1898.

Ricardo, Rec. Ind. Mus., IV, p. 240, 1911.

Kertesz, Cat. Dipt., III, p. 249. 1918:

Tabanus luridus, Fallen, 臨時馬疫調査委員會研究成績(馬政局)第二稿 Pl. VI, fig. 4, 1914.

Medium-sized blackish brown species, with two separated frontal calli on the narrow frontal stripe, yellow subcallus, five very faint greyish stripes on the thorax, conspicuously ashy grey tomentose scutellum, whitish tibiae, and pale yellowish grey bands and median triangles on the abdomen.

Female. Head broader than the thorax, moderate in length, and slightly arched. Frontal stripe covered with yellowish brown or yellowish grey tomentum, and more or less paler below, narrow and contracting from the vertex to the front eye-angles, and wholly six times as long as its narrowest part or about four times as long as its broadest part; lower frontal callus blackish with the lower part somewhat yellowish brown, shining, very slightly convex, elongate square with the somewhat straight margins of which the upper margin sometimes irregularly notched and the lower margin often pointed below, and in the middle there is more or less distinct longitudinal sulcus through the whole length, separated from the subcallus by a rather narrow dusted interval; the upper frontal callus very narrow and elongate, about as long as the lower one, sharply pointed in both ends, deep black and shining; frontal triangle moderately elevated and almost wholly occupied by yellow shining subcallus leaving a very narrow

yellowish grey tomentose double crescent just above the antennal fossae and a very narrow similarily dusted lateral margins which do not extend up to the upper angles and the subcallus with a distinct though very narrow median longitudinal sulcus ; vertex dark without any trace of the ocelligerous tubercle ; pubescence on the frontal stripe rather dense, sloping, and black, but on the tomentose space above the lower frontal callus paler and sparser and on the interval between the subcallus and the callus practically wanted, the black pubescence being slightly longer and much denser towards the vertex behind which some erect black pubescence occurs. Face broad and moderately raised ; epistoma densely covered with yellowish ashy tomentum and numerous long straight sloping white pubescence, with deep but not large lateral pits ; cheeks broad, the broadest part being wider than the half of the epistoma which is broader than the length, covered with dense ashy grey tomentum which becomes yellowish or yellowish brown on the upper part, the coloured dust extending over or less half way bellow to the jowls along the outer margin ; pubescence on the cheeks numerous and erect, white on the ashy grey part, and brown on the yellowish part especially on the upper-inner corner conspicuous, the white pubescence becoming longer and shaggier on the jowls and extending a little up to the back of the head where the pubescence becomes again shorter and sparser. Back of the head shallow on the lower part but hollowed out on the upper part, covered with ashy grey tomentum and some scattered whitish pubescence ; the postocular bare rim rather broad, about equal in width throughout the whole length but slightly narrowed near the vertex and moderately broadened near the jowls, and behind this rim is rather long brownish black ciliation which shorter and yellowish below to the jowls. Proboscis about two-third as long as the depth of the head, stout, brownish black, the stalk with a long dense white fringe behind ; the sucker-flaps darker, about two-third as long as the proboscis, and furnished with a few scattered short blackish bristly hairs below. Palpi slender and long, reaching near the top of

the proboscis, pale yellowish obscured by greyish tomentum; first joint small, somewhat globular, covered with dark grey tomentum on the outside, and bearing numerous long very pale yellowish white pubescence similar to that on the mouth-edge, and with two or there shorter but stout black bristly hairs intermixed near the apice; second joint long and narrow, moderately thickened about the basal half and then drooping and gradually narrowed to a rather blunt point, and wholly or less four times as long as its broadest part; this second joint on the outside covered with less dark greyish tomentum and with short but comparatively long white pubescence which grows up longer about the basal part, and with some (or sometimes numerous) shorter black hair intermixed except about the base and on the underside, while the inner side hardly pubescent or tomentose. Antennae much shorter than the palpi, reddish yellow with two basal joints pale yellowish; basal joint very slightly covered with yellowish grey tomentum, and bearing abundant but not dense tiny depressed black pubescence which gradually becomes much shorter and sparser towards the under surface where there are some long and thin whitish hairs which extend up to the whole outside and enter into the black pubescence, this joint thickened apically and produced dorsally somewhat conspicuously cap-like over the second, the top of this extension being blackish; second joint small but about half as long as the first joint, similarly coloured or tomentose as in the latter, with a complete rather dense circlet of tiny black bristles about the apice where there is a short but distinct spine-like process on the upper side; third joint rather broad, wholly three times as long as two basal joints together, wholly two and a half times as long as its broadest part where the dorsal hump situates, reddish yellow with style-like portion darker; the basal annulation of the third joint stout and shorter than the twice of the width of the broadest part, with the conspicuously produced dorsal hump near the base, the tooth at the top rounded or pointed and crowned with a few tiny black bristles, the dorsal margin after this

tooth moderately concave; the style-like portion of the third joint comparatively short and stout, gradually narrowed to a point where there are one or two tiny but conspicuous black pubescence, the annulations lengthened one after another, and the tip one wholly twice as long as basal one, and on each annulation there are two or three minute pubescence near the apex. Eyes large, bare from pubescence, with all the facets practically equal in size, in death deep purplish black with strong metallic ruster; in profile about one and a half times as deep as long, irregularly oval, the frontal margin being longest and slightly curved anteriorly, and the remaining margin being almost evenly rounded semicircularly; when seen from in front deeper than wide, the frontal angle about 130°, the lower angle about 110° with rounded angle, the upper angle about 99°, and the outer angle evenly rounded.

Thorax short but longer than the width, blackish, slightly shining though it covered with greyish tomentum, with three yellowish grey median stripes and broad similar coloured lateral stripes, these stripes being very faint and of which the middle one is narrowest and hardly extends behind the suture, and the next pair is nearly reaching the hind margin of the thorax and is slightly inwardly oblique after the suture, while the lateral pairs is very broad, occupying whole the sides, but obscure behind the praealar calli; these longitudinal bands whitish grey on the anterior border, and the rest somewhat yellowish on account of the yellowish recumbent pubescence, which also extends about the suture and the hind margin; the pubescence mostly short and yellowish, which is especially conspicuous on the parts mentioned above, and intermixed with numerous but rather scattered longer (still short) erect black hairs all over the surface, three black hairs becoming paler on the anterior vertical border; humeri in the lateral bands rather large and prominent, covered with ashy grey tomentum and mainly pale long pubescence; praealar calli in the lateral bands large and distinct, triangular, covered with pale yellowish grey dust and bearing short (but longer than that on the disc) yellowish

pubescence with numerous long stout shaggy black hairs intermixed especially at the posterior corner; postalar calli also including in the lateral bands, covered with ashy grey tomentum, bearing rather long dense yellow pubescence, and on the hind margin there is a long dense whitish tuft; the rather long space between the praealar and postalar calli, above the wing-bases, occupied almost wholly the posterior part of the lateral band, brownish or reddish brown, obscured by yellowish brown tomentum except on lower part just above the wing-base dusted with whitish grey; scutellum somewhat semicircular with blunt rounded posterior margin, covered with dense ashy grey tomentum, and bearing numerous short depressed yellow pubescence with abundant but scattered long erect yellowish hairs intermixed all over the surface. Pleurae blackish but entirely obscured by ashy grey tomentum, and covered with abundant (but not dense) long white pubescence which becomes more numerous above; on the posterior margins of the prothorax, and the meso- and meta-pleurae, there are long tufts of whitish hairs similar to those on the rest.

Wings shorter than the thorax and abdomen together, clear, with light brown veins, of which the radial vein, the long base of the postical vein, and the stem of the cubital fork, are yellowish, and with stigma yellowish brown; all the posterior cells widely open, the discal cell large and longer than the second posterior cell, and the anal cell closed long before the wing-margin; the upper branch of the cubital fork without recurrent veinlet or sometimes abnormally with a short one. Squamae in the alar pair greyish, with brown margin and a rather conspicuous blackish fringe except for the long yellowish tuft of long hairs about the angle; in the thoracal pair brownish, with a dark brown margin and inconspicuous whitish fringe. Halteres dark brown with the apices of the knobs and the stalks more or less paler.

Legs rather slender, blackish, with the basal half of the front tibiae and basal five-sixth of two pairs of the posterior tibiae pale yellowish white, and with the extreme tips of the femora yellowish;

front coxae stout and wholly two thirds as long as the front femora, conspicuously dusted with ashy grey, covered with numerous long white pubescence which becomes conspicuously shorter and much sparser towards the top; front femora obscurely dusted leaving the broad flattened subfemoral bare space which is finely transversly striolate and strongly shining, and on the inner margin of the bare space there is a comparatively long dense black ciliation; the pubescence on the front femora black, very short and depressed on the inner side, but very long erect on the outer side where the black pubescence is mingled with rather numerous fine more or less shorter white hairs; two pairs of the posterior femora more obscured by a greyish tomentum than in the front femora, covered with numerous fine and short pale yellowish white pubescence, which grows up longer on the underside, especially about the base; the pubescence on the middle femora always longer than that on the hind one, and on the underside there are some scattered blackish hairs near the base; front tibiae very slightly incrassate, and curved, the yellowish basal half covered with rather dense short depressed white pubescence with a few very scattered similarly short black hairs intermixed, the black apical half densely covered with similarly short and depressed but black pubescence, and the underside more or less reddish brown on the basal half; two pairs of the posterior tibiae covered with short white and black hairs as the front tibiae, but these hairs slightly longer and less depressed especially on the middle pair which bears two unequal blackish tipped spurs; all the tarsi densely covered with short black bristly hairs, the front pair bearing some scattered brownish black touch-hairs, which extend up to the apical part of the front tibiae, while the posterior two pairs have the reddish brown soles; pulvilli dull yellowish brown, and claws deep black.

Abdomen long, somewhat conical, about twice as long as the thorax (including the scutellum), the basal part slightly broader than the thorax, and then gradually narrowed towards the anal apex

which is rounded. Dorsum strongly convex, blackish, very slightly shining, with five distinct yellowish white bands, as the hind border of each segment (except the basal and terminal segments) conspicuously and rather broadly dusted with ashy grey and covered with pale yellow pubescence; each of these bands being narrower than the preceding one, and first three bands triangularly swollen anteriorly in the middle, as if one may sometimes say that the abdomen has a series of the median triangles; the first segment on the whole sides covered with an ashy grey tomentum and whitish pubescence, and the median posterior margin obscurely dusted with yellowish brown, and on its median incised portion bearing yellow pubescence; the second segment with the extreme sides ashy grey and covered with white pubescence on there; the sides of two following segments more or less brownish, and bearing depressed yellowish pubescence with long erect stout black hairs intermixed; the sides of the fifth and sixth segments covered with long erect black hairs, but the extreme margins more or less reddish brownish; the terminal segment wholly blackish and covered with numerous long erect black pubescence; the pubescence on the rest long and sloping, black. Ventre moderately convex, blackish, covered with an ashy grey tomentum and a short white pubescence; the seventh segment not obscured by greyish dust but with brownish one and covered with numerous long and stout erect black bristly hairs, and two preceding segments more or less furnished with long stout sloping black hairs about the basal half especially on the sixth segment.

Length: 12-13.5 mm.

This species is closely allied to *Tabanus iyoensis*, but easily distinguished from the latter, by its larger size, by the much broader yellowish pubescent abdominal bands, by the yellowish haired scutellum, by the more produced dorsal hump of the antennae, by the more yellow pubescent dorsal thorax with five very faint stripes, by the white pubescence on the front femora, by the median series of three

distinct triangles on the dorsal abdomen, and by the reddish yellow pubescence at the middle of the posterior margin of the first segment of the dorsal abdomen.

The denuded specimens well agree with Coquillett's very short description of *T. humilis*, and in my large collection of Japanese *Tabanidae* and in Prof. Matsumura's materials there is no other species which may be identified by any entomologists as this species; I am therefore inclined to make an adventure and describe this species as it.

This fly is not uncommon in the northern parts of Honshu and in the mountainous districts of South Japan, and its occurence is abundant in August, and gradually diminishes towards October, and after this season the fly disappears all over the districts. It is known that the female bites pasturing horses or cattle, or sometimes attacks them when tied up or in a shed and it is probably one of the transmitters of a certain infectious anoemia of horses. The female occasionally pierces the human face near neck, with her stout proboscis, and sometimes on the back through summer clothes.

12. **Tabanus aurotestaceus,** Walker.

List Dipt. V, suppl. I, pp. 214 & 253, 1854.

V. d. Wulp, Cat. Dipt. South Asia, p. 60, 1896.

Kertesz, Cat. Dipt., III, p. 226, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 163, 1911; Ann. Mus. Nat. Hung., XI, p. 168, 1913.

A yellowish medium-sized species is distinguished by a broad yellow median stripe on the abdomen, by a long very narrow greenish yellow frontal callus on the very narrow frontal stripe, by yellowish legs and clear wings, and by yellowish brown thorax and scutellum.

A species near *Tabanus hybridus*, Wiedemann, but distinguished by the wholly clear wings and black fore femora. A yellowish medium sized species with a broad yellowish median stripe on the abdomen. Fore head narrow. Legs yellowish, fore femora black, tibiae white. Length: 17-18 mm. in the females; 17 mm. in the male.

Female. Face yellowish with yellow hairs. Cheeks and subcallus a darker shade of yellow. Palpi the same as these last in colour, fairly stout ending in an obtuse point, with black pubescence. Antennae bright red, the first two joints paler, with black hairs, the third broad at the base with distinct tooth. Forehead about nine times as long as it is broad, barely half as wide anteriorly as it is at vertex. Frontal callus greenish yellow very narrow, not reaching eyes, with a lineal extension. Thorax covered with yellowish brown tomentum and with fulvous hairs, a few black hairs intermixed. Scutellum the same. Abdomen a little darker in colour, the stripe composed of golden yellow hairs, which are also scattered over the rest of the dorsum, but intermixed with black hairs, sides of abdomen yellow hairs. Legs yellowish, the fore femora black, the fore tibiae white, black at the apex, the other tibiae whitish yellow. Tarsi black, pubescence yellow on pale parts, black on the dark parts. Wings clear, veins yellowish.

Male. It has a very large head, *Atylotus*-like, flat above, the small facets occupying the lower third of the eyes and continued as a narrow border to vertex. Thorax and abdomen covered with yellowish tomentum and with black and some yellow hairs. Legs pale yellow, fore femora black, tarsi blackish. The yellow stripe on abdomen is very broad, about a third of the width of abdomen.

This male type and a very poor female preserved in the British Museum are known to me, but I have no knowledge of Formosan species. This is probably a very uncommon species in Formosa Island, while it is recorded from Shanghai (China) and long Son (Tongking).

13. **Tabanus abbreviatus**, Bigot. (Pl. VII. fig. 1).

(Misuji-Abu)

Mem. Soc. Zool. France, V, p. 670, 1892 (*Atylotus*).
V. d. Wulp, Cat. Dipt. South Asia, p. 63, 1896.
Kertesz, Cat. Dipt., III, p. 217. 1908.
Ricardo, Rec. Ind. Mus., IV, p. 153, 1911.

A medium-sized greyish red-yellow species with the thorax greyish black, abdomen with a narrow median, and fainter lateral stripes. Frontal stripe narrow with a long reddish brown or brown callus; antennae and legs pale reddish brown; wings clear with costal border yellowish.

Female. Head a little broader than the thorax, moderately long and arched. Frontal stripe rather narrow, slightly contracting from the vertex to the eye-angles, and about seven times as long as its narrowest part or about five times as long as its broadest part, covered with yellowish brown tomentum and with very short black hairs which gradually become sparse and inconspicuous towards the lower part where the pubescence is hardly recognisable; frontal callus reddish brown or brown, very slightly convex and oblong, not reaching the eyes, diminishing to a long narrow line, this linear part being distinctly longer than the broad part and sharply pointed upwards; vertex slightly darker, with rather conspicuous black pubescence which is slightly longer and much denser than that on the part just below the vertex behind which there is some distinct longer (still short) black bristly hairs; frontal triangle nearly flat, covered with yellowish tomentum, and in the middle there is a fine but distinct longitudinal sulcus throughout, separated from each cheeks by a more or less distinct shallow groove which is hardly perpendicular but slightly divergent outwardly and which is not reaching to the eye-margin with a somewhat conspicuous but very shallow depression at its end. Face somewhat strongly convex with the prominent epistoma which is comparatively large and is slightly widened below and is broader than long,

while the cheeks are consequently narrow and gradually broadened towards the jowls, their apical angles being rather sharp and extending up to the level of the upper margin of antennal fossae; the face covered with ashy grey tomentum which becomes slightly yellowish at the apical corner of the cheeks, and with abundant short silvery white pubescence which is suberect on the epistoma and is quite erect on the cheeks, at where the pubescence grows up longer and denser about the jowls but much shorter and sparser towards the upper part; back of the head moderately hollowed out, covered with some scattered white pubescence, which on its lower part is a continuation of that on the jowls but shorter and sparser; postocular bare rim very narrow ashy grey, equal in width throughout though slightly narrowed near the upper eye-angles, behind this rim there is a short and rather dense yellowish grey ciliation which extends below to the jowls. Proboscis rather long but much shorter than the depth of the head, moderately stout, dark brown, furnished with somewhat conspicuous greyish tomentum and some short and erect whitish pubescence behind the stalk; sucker-flaps large, about half as long as the whole proboscis, darker than the rest, bearing a few scattered short blackish bristly hairs. Palpi slender and long, but much shorter than the proboscis, pale yellowish white: basal joint small, about fourth as long as the end joint, covered with abundant long whitish hairs similar to those on the jowls; second joint long and slender, but stout about the basal third and then drooping and gradually narrowed to a roundish point, about three and a half times as long as its broadest part, thickly beset on the outside with short depressed black bristly pubescence. Antennae reddish brown with the style-like portion of the third joint blackish; the basal joint short but cylindrical, slightly dusted with greyish on the outside, the dorsal apex moderately produced over the second joint, and the dorsal half furnished with tiny black bristly pubescence which does not extend to the basal extreme; second joint small, wholly half as long as the first joint, with a rather conspicuous dorsal process on

the apical margin, and near the apex with a complete circlet of tiny black bristles which become sparser on the inner side; third joint about two and a half times as long as the basal two joints together, and less than the three times as long as its broadest part; the basal annulation of the third joint very broad, about one and a half times as long as its broadest part and longer than the style-like portion, the dorsal margin strongly concave about the middle just before this concavity with the dorsal hump strongly produced up and crowned with minute black bristles, and the ventral margin somewhat angularily convex below the dorsal hump; style-like portion gradually tapering to a point, with three basal annulations somewhat transversely quadrate, each annulation bearing two or three minutes blackish pubescence. Eyes moderate in size, when seen from above somewhat flat-triangular with slightly curved outer-margin and with inner-margin apparently shorter than the hind margin, the upper angle about 100°; in profile conspicuously deeper than the length, pear-shaped with a upper part narrowed; when seen from front about as deep as wide, the frontal angle about 145°, the lower angle about 110° with rounded angle, the upper angle nearly 90°, and the outer angle evenly rounded; in death deep purplish black with some greenish shimmer without any markings or bands, all the facets in practically equal.

Thorax large, oblong, very slightly narrowed anteriorily, about two and a half times as long as the head, blackish, closed with yellowish brown grey tomentum, and coloured with short recumbent whitish grey pubescence which is intermixed with short but suberect black hairs all over the surface, both the whitish and black hairs becoming longer denser more erect about the sides; the dorsal stripes very indistinct, of which the middle lateral two are somewhat recognisable and bent outwardly on the suture at where these stripes are connected with the broadest side ones, and the middle stripe more faint and not extending throughout but from the anterior border to about the middle, while the outerest stripes are broadest and greyish and extend from

the humeri to the postalar calli, passing on the praealar calli and the upper bases of the wings, and their posterior halves with rather conspicuous brownish inner margins which extend from the upper corners of the praealar calli to just after the anterior ends of the postalar calli; scutellum somewhat semicircular with the basal margin nearly straight, covered with similar tomentum and hairs to the posterior border of the thorax; just above the wing-bases and on the lower margins of the posterior calli there are the conspicuous long (but still short) whitish grey tufts. Pleurae blackish but obscured by ashy grey tomentum, and covered with short but longer than that on the disc of the thorax, and erect whitish pubescence which grows slightly longer up to the upper part and is intermixed with long erect stout black hairs on the upper half of the mesopleurae; on the prothorax and ptero-pleurae, and on the postero-upper margins of the meso- and meta-pleurae there are long dense shaggy whitish grey tuft.

Wings about as long as the thorax and abdomen together, clear with the costal cell and stigma yellowish brown, with the veins brown, of which the radial and postical veins, and the stem of the cubital fork more or less yellowish; all the posterior cells widely open but the first one more or less contracting towards the wing-margin; discal cell large and slightly longer than the second posterior cell, and anal cell closed a long before the wing-margin; the upper branch of the cubital fork without recurrent veinlet. Squamae glassy grey in the alar pair with a dark brown margin and short and dense blackish fringe of rather stout and erect hairs, and in the thoracal pair with a brown margin and a short and sparse greyish fringe; the tuft about the angle yellow and long.

Legs blackish, with the extreme apices of the femora, the basal half of the front tibiae, and two pairs of the posterior tibiae, reddish yellow; front coxae moderately dilated and wholly two-thirds as long as the front femora, covered with dense ashy grey tomentum and with numerous long silvery white pubescence which becomes shorter apical-

ly; front femora slightly obscured by grey tomentum, excepting on the broad shining transversely striolate subfemoral bare space, on the inner margin of this bare space with a distinct (though very short) blackish ciliation, and on the outside with a long and dense whitish grey pubescence intermixed with abundant stout black hairs especially on the upper half; pubescence on two pairs of the posterior femora mainly whitish grey and shorter, intermixed with abundant black hairs on the dorsal surface; front tibiae not dilated but slightly curved after the middle part, the underside almost always darker, covered with very short and depressed black pubescence which is intermixed with some similarly short pale yellowish white hairs on the paler portion especially on the upper surface; middle tibiae slightly darker towards the apex, covered with numerous short and depressed black pubescence which becomes sparser on the underside where it is intermixed similarly short yellowish hairs, and the apex with two unequal rather stout blackish spurs; hind tibiae somewhat darker apically, covered with short black pubescence, and bearing a rather conspicuous but short black outer-upper fringe and a less conspicuous and much shorter yellowish inner-lower fringe; tarsi all blackish but the front pair deep black, while the posterior two pairs have somewhat orange coloured soles; pulvilli yellow, and claws black with the bases brownish.

Abdomen slightly broader than the thorax, and wholly as long as the head and thorax (including the scutellum) together, gradually narrowed to a blunt point. Dorsum reddish yellow, slightly obscured by a greyish tomentum, more or less darker towards the apex, especially on the last three segments with three distinct greyish stripes of which the middle one is narrow, and almost wholly continuous, and is almost equal in width throughout but sometimes composed of triangles though it is quite continuous, while the side stripes appear less distinct indicated by the oblong narrow spots forming more or less continuous stripes, and they are not well-defined and gradually narrowed to an inconspicuous point on the sixth segment; intervals between the mid-

dle and side stripes usually brown, and the outer side of the latter also brown, but the extreme sides of the segments greyish reddish yellow; pubescence on the surface short and depressed, black, which on the stripes is yellowish and on the side-margins whitish and longer, but on the middle stripe yellowish pubescence intermixed with abundant black hairs similar to those on the rest of the disc; the seventh segment blackish throughout, without any stripes, and densely covered with longer black bristly hairs. Ventre light reddish yellow and more obscured by ashy grey tomentum, but the posterior part more or less darkened especially on the last two segments, covered with fine silvery white pubescence which is conspicuously intermixed with slightly longer black hairs on the broad median part throughout the whole length; seventh segment only long and erect but curved black bristles, and the preceding segment bearing some long sloping black bristly hairs.

Length: 15–17 mm.

In five specimens from Formosa it varies a little in the median stripe as described above, and in the colour of the abdomen both dorsally and ventrally, as one material is much more darker, and the other one is more conspicuously reddish yellow. It is easily distinguished from our horse-flies by three continuous stripes on the greyish red-yellow abdomen, but is rather closely allied to *Tabanus albimedius*, Walker, from India, and special attention must be given to the narrow frontal stripe of the female, more slender palpi covered with black pubescence, darker legs, reddish yellow abdomen, and broader basal annulation of the third antennal joint.

The male of this species may be *Atylotus conicus*, Bigot, according to the Ricardo's identification, but I cannot discuss it further as I have no male specimens.

The occurence of this *Tabanus* is probably restricted to the southern parts of Formosa, as I have a record from Takao only (June). In Formosa, in June the female bites horses and cattle, as well as

human beings, but her attacking the latter may not be severe to the latter. In other countries, it is recorded from Java, India, and the Malay Fedarate States.

14. **Tabanus miyakei**, Shir. (n. sp.) (Pl. VI, fig. 2 ; Pl. XI, figs. 1 & 2),

(Miyake-Abu)

Rather small-sized pale greyish yellow-brown species, with a roundish castaneous frontal callus on the rather broad nearly parallel-sided deep yellowish brown frontal stripe, with the slightly paler abdomen and legs, and with the wings tinged with brown at the costal margin.

Female. Head apparently broader than the thorax, but rather short and somewhat flat-triangular when seen from above. Frontal stripe slightly contracting from the upper part down to the front eye-angles, and wholly three times as long as its broadest part or nearly four times as long as its narrowest part ; frontal stripe covered with a dense yellowish brown dust, and bearing a short but rather stout sloping blackish pubescence which becomes denser on the vertex at where it has no ocelligerous tubercle ; frontal callus shining brownish, almost rounded and globular, never touching the eyes at any part, and with no extension ; frontal triangle moderately convex, the same as the frontal stripe in colour, bare from pubescence, and with a very fine inconspicuous median sulcus ; face dull greyish yellow but slightly paler below, conspicuously raised from the eye-margins, with two rather large lateral pits, and bearing almost no hairs on the epistoma but on the side-cheeks there are some conspicuous stout blackish brown hairs especially about the upper outer corners which are deep yellowish brown as the frontal triangle ; jowls moderately inflated, ashy greyish, with long greyish yellow pubescence which is not extend up to the back of the head ; all along below the eyes and up all the back of the head to the vertex is a narrow dull yellowish (becoming brownish at

the temple region), bare rim, behind which is a rather short though rather crowded ciliation of yellowish brown hairs which extend to the vertex; back of the head light yellowish grey but becomes yellowish brown upwards, and bearing some scattered blackish hairs. Proboscis yellowish brown, wholly two-thirds as long as deep of the head, with the rather long sucker-flaps which bear some erect brownish bristly hairs on the underside, the stalk rather short and furnished with a pale yellowish pubescence behind. Palpi dull pale yellowish, the second joint almost obscured by short dense depressed black bristles amongst which on the basal part (especially below) are some distinct whitish soft hairs, the basal joint covered with numerous long somewhat shaggy whitish hairs, intermixed with a few black pubescence about the apex; palpi apparently shorter than the proboscis, rather slender, the basal joint wholly one-third as long as the apical joint which is about three and a half times as long as its thickest part, rather broad from the base up to about the middle, after which they droop and gradually diminish to a narrow round-tip, quite bare on all the inner side but with two or three longer pale hairs beneath about the base. Antennae rather large, light reddish yellow; the basal joint more dull yellowish, about as long as broad, bearing numerous but rather sparse short black bristly hairs which grow slightly longer about the broad apex especially beneath; second joint in colour the same as the basal joint, about half as long as the first joint but not conspicuously narrower than that; bearing a circlet of short black bristles around the tip, which are rather longer on the underside; third joint less than three times as long as the basal joints together, darkened at the tip, with a very flat dorsal hump near the base; basal articulation of the third joint rather broad and short, less than twice as long as the style-like portion, and about two and a half times as long as its broadest part; style-like portion rather large, with short conical apical articulation which is slightly longer than the third articulation and which bears some somewhat conspicuous but short black bristles at the tip. Eyes

quite bare from pubescence and with practically equal small facets, in death greenish black with three narrow inconspicuous purplish black bands of which the middle one extends from just above the frontal eye-angle to before the outer angle and is nearly straight, and the lower one is nearly parallel to the middle one but at the outer end curved upwards, while the upper one is most inconspicuous and is rather narrowly separated from the middle; eyes (when seen from in front) as wide as deep, with the frontale angle about 120°, with the upper angle about 90°, the frontal margin straight, the facial margin apparently shorter than the frontal margin and slightly curved outwards, and with the outer margin strongly convex; in profile distinctly shorter than deep, with the narrow top-angle and the broad frontal angle rounded, and with the straight frontal margin.

Thorax rather small, somewhat roundish, greyish reddish brown, nearly unicolorous but at the apical part slightly paler, covered with short depressed yellow pubescence intermixed with some short erect blackish hairs which are most conspicuous and longer on the praealar calli; pleurae obscured by ashy grey tomentum, and bearing long but inconspicuous thin pale yellowish hairs which become more conspicuous on the meso-, ptero-, and meta-pleurae; scutellum the same as the thorax but its pubescence more conspicuous and longer.

Wings smoky especially on the fore border and along the veins, with brown veins of which the cubital and postical veins are conspicuously yellowish; all the postical cells widely open; anal cell closed before the margin with a rather short petiole; discal cell moderate in size, and longer than the second posterior cell; upper branch of the cubital fork without veinlet. Squamae in the alar pair quite smoky and with a blackish margin; in the thoracal pale brown and with a dark brown margin; fringes very short, rather inconspicuous, brownish, but angle-tuft long conspicuous and pale yellowish.

Legs yellowish brown, with the tarsi darkened; frontal coxae obscured by a whitish tomentum and covered with numerous whitish

pubescence which is intermixed with some brownish hairs especially on the inner margin; front femora covered with short yellowish white pubescence, and bearing a short dense ciliation of blackish bristly hairs on the inner margin of the shining base subfemoral space and a rather sparse fringe of long blackish hairs with some similar but pale yellowish ones intermixed; middle and hind femora covered with inconspicuous yellowish white pubescence on the inner and lower sides, and with conspicuous (but still short) blackish hairs on the rest; tibiae covered with numerous short blackish pubescence, the front pair slightly broader than the others and moderately curved at the middle, and the middle pair bearing rather short unequal blackish spurs which are reddish at the base; tarsi slightly darker than the tibiae and covered with numerous short black bristly hairs which become reddish orange on the underside of the posterior two pairs, with yellowish brown claws tinged with black at the apical half, and with dull yellowish grey pulvilli.

Abdomen long and narrow, about one and a half time as long as the head and thorax (including the scutellum) together, and slightly broader than the thorax about the base at where it is broadest, and gradually narrowed to a rounded apex; dorsum reddish yellow, with a narrow inconspicuous yellowish median stripe and more indistinct similar coloured segmentations, the former extending from the first segment to the sixth segment; pubescence on the dorsum fine, soft, depressed, and black, but on the stripe and segmentations there are abundant similar but pale yellowish hairs, and at the sides there are slightly longer and more erect paler yellowish hairs intermixed; the apical segment slightly darkened; belly paler than the dorsum and more or less obscured by an ashy grey tomentum espically on the basal segments, covered with numerous but not dense very short depressed pale yellow pubescence all over the surface, but on the apical two segments there are abundant long suberect blackish bristly hairs intermixed.

Length: 11 mm.

There is no allied species in Japan and Formosa, and this species is somewhat similar to *Tabanus puteus*, Ricardo, from Ceylon but quite different.

Described from only one but quite perfect female from Mansuw (Koshum in South Formosa), collected by Mr. K. Miyake, on the first of May, 1918.

15. **Tabanus okinawanus,** Shir. (n. sp.) (Pl. fig. 3; Pl. XI, figs. 3 & 4).

(Okinawa-O-Abu).

Rather large brownish species with a long frontal callus on the narrow brownish yellow frontal stripe, with the very small dorsal hump of the narrow reddish yellow antennae, with three very fine but rather well-defined brownish yellow-grey median stripes and a pair of rather indistinct though broad greyish lateral stripes on the yellowish brown thorax, with a narrow interrupted black median stripe and very small yellowish grey haired median spots on the reddish brown dorsal abdomen, with the blackish legs, and with the infuscate wings.

Female. Head slightly broader than the thorax, moderately arched behind. Frontal stripe brownish yellow, very narrow, gradually contracting from the vertex to the lower end and about eight and a half times as long as its narrowest part or wholly six times as long as its broadest part, furnished with numerous very short rather erect black pubescence which becomes conspicuously dense on the vertex and behind that there is no special outstanding or over-lapping long fringe; frontal callus not touching the eye-margins, oblong with the lower end roundish and with a long fine linear upper extension which is more than twice the length of the callus proper. Frontal triangle slightly elevated below, dusted with orange yellow, on the upper margin there are two very small blackish spots at the sides, the median sulcus

very fine but entire. Face somewhat brownish orange yellow but conspicuously brownish tinged on about the upper half of the cheeks, while the lower part is paler; epistoma broader than long, bearing a few very minor black pubescence on about the middle, numerous longer conspicuous curved similar coloured hairs on about the upper lateral corners, and a few short paler pubescence about the lateral pits; cheeks covered with a short erect black pubescence which becomes longer below and on the jowls at where there are numerous long pale hairs intermixed, the paler hairs extending a little up to the back of the head; back of the head shallow about the lower part and moderately hollowed out above, covered with a dense yellowish grey tomentum and a scattered somewhat long pale pubescence, and against the eye-margin there is a narrow greyish yellow tomentose postocular bare rim which becomes slightly narrowed about the temple region and behind which is a black short ciliation extended below to the jowls. Proboscis blackish, about as long as the head is deep, furnished with a black pubescence behind the stalk and with similar but shorter bristly hairs beneath the large sucker-flaps. Palpi slender, pale brownish yellow with the basal joint blackish brown; end joint only moderately stout on about the basal half but then drooping and gradually diminishing to a blunt point, longer than four times the width of the stoutest part, clothed with rather dense black bristles all over the surface except on the obsolete inner side and with a few longer thin inconspicuous black hairs beneath the base; basal joint small and about one-fifth as long as the apical one, covered with a yellowish grey tomentum and numerous long black hairs. Antennae long and slender, yellowish red with the basal two joints more yellowish and with the style-like portion blackish; first joint at the apex thickest and hooked over the base of the second joint, about one and a half times as long as its stoutest part, covered with numerous short depressed black pubescence which becomes sparser on the inner side and on the extreme base, while on the narrow underside there is no pubescence excepting of a

very few slightly longer black hairs on the tip; second joint small and about a half as long as the basal joint, with a small triangular apical process above, covered with numerous tiny black bristles almost all over, excepting on the extreme base; third joint about two and a half times as long as the basal two joints together, the basal annulation rather narrow and about two and a half times as long as its broadest part, with a very short rather broad dorsal tooth before the middle, and with a very broad blunt lower angle right below the dorsal hump, the lower margin being very slightly concave after the bent, the dorsal hump and the lower angle bearing very few tiny black bristly hairs, some similar but more inconspicuous pubescence occuring about the middle of the basal part; style-like portion narrow and rather long but about two-fifths as long as the basal annulation of the third joint, the first three annulations subquadrate, of which the middle one is shortest and somewhat transverse, and the apical one is longest and as long as wide, while the absolute apical conical annulation is very slightly shorter than the preceding two together and bears some fine inconspicuous blackish pubescence on about the apical half, but on the other annulations there are only one or two. Eyes bare, with the facets all equal in size, in death deep bluish black with some metallic ruster in a certain light; when seen from above the hind margin straight and about one and a third as long as the frontal margin, the outer margin moderately convex but the apical part nearly straight, the top angle about 95°, and the frontal angle about 65°; in profile oval with the top angle narrowly roundish, deeper than long, the frontal and hind margin moderately convex, and the lower margin strongly convex; when seen from in front about as deep as wide, the facial margin very slightly convex and shorter than the frontal margin, the frontal angle about 135°, the top angle about 95°, and the lower angle about 110° and rounded.

Thorax comparatively small, rounded, about as long as wide, blackish, obscured by a yellowish brown tomentum which becomes paler at the vertical part, with three very distinct though very narrow widely separated yellowish grey stripes of which the middle one is nearly reaching the hind margin, and the outer pair is slightly broader than the middle one and is interrupted at the suture extending from the fore margin to the hind margin almost equidistant from the middle stripe throughout the whole length, while on each side of the thorax there is a broad not well-defined more greyer lateral stripe which is interrupted at the suture and is connected with the outer middle stripe there, and on the hind part of the space between the lateral and outer middle stripes there is also an inconspicuous spot-like short greyish stripe rather near to the former than to the latter; pubescence on the disc short, erect, and black, intermixed with an inconspicuous still short rather depressed yellowish hairs especially on about the suture conspicuous; humeri reddish brown, obscured by a greyish dust and bearing abundant long yellowish grey hairs but those on nearly the upper half short and black; praealar calli rather conspicuously greyish black, covered with abundant (though not dense) stout somewhat long black hairs intermixed with some shorter yellowish ones, and on the lower margin there is a long dense black fringe composed of numerous erect stout hairs which extend up to the area between the humeri and calli, at where there are some long yellowish grey soft hairs intermixed, postalar calli rather small and not conspicuous, somewhat blackish but near the scutellum rather reddish, clothed with rather longer black pubescence intermixed with some short yellowish hairs, and on the anterior part of the outer margin with a rather inconspicuous though somewhat long yellowish grey tuft, the similar but shorter and less distinct one on the upper base of the wing. Pleurae densely covered with a yellowish grey tomentum and bearing numerous long yellowish grey soft pubescence which becomes almost entirely black on the mesopleurae and which is intermixed with rather numerous black hairs

on the sternopleurae, the black pubescence on the mesopleurae becoming longer and more denser on about the postero-upper four-fifths; prothorax paler than the pleurae, and covered with abundant long yellowish grey hairs, the similar pubescence on the pteropleurae; on the postero-upper margins of the meso- and meta-pleurae there are long pale brownish yellow-grey fringe. Scutellum as the thorax; but the pubescence all slightly longer and along the margin with abundant conspicuous yellowish hairs.

Wings slightly shorter than the thorax and abdomen together, moderately tinged with brownish but more or less yellowish towards the base; the costal cell rather conspicuously brownish yellow, stigma pale brown, and the veins brown excepting of the postical, radial, and cubital veins, more or less yellowish; discal cell as usual and slightly longer than the first posterior cell which is slightly but distinctly contracting towards the margin, the remaining posterior cells all widely open, the anal cell closed with a long petiole; upper branch of the cubital fork with a distinct recurrent veinlet. Squamae in the alar pair grey, with a dark brown margin and with a dense pale brownish yellow-grey fringe excepting of the long greyish yellow tuft about the angle; in the thoracal pair pale reddish brown, with the deep castaneous brown margin, and with a pale brownish yellow fringe. Halteres blackish brown, with the extreme tip of the knobs dull brownish yellow.

Legs blackish, with the tibiae reddish brown and more or less darkened apically; front coxae dilated and about four-fifths as long as the front femora, clothed with a dense yellowish brown tomentum which becomes paler towards the apex, and bearing an abundant brownish black pubescence which on the outer basal part is intermixed with rather abundant yellowish hairs; front femora at the extreme apex yellowish, very slightly covered with a greyish tomentum leaving a broad shining black subfemoral bare space which is distinctly transversely striolate and is slightly hollowed out at the apical part, clothed with nume-

rous short stout depressed black pubescence on the inner and upper sides, and on the inner margin of the bare space there is a short black ciliation, while on the outer side there is a long broad black fringe, all the pubescence on about the base more or less intermixed with paler hairs, middle femora with the yellow tips, more dusted, clothed with a numerous short depressed black pubescence, on the hind side there is a long yellowish fringe which is intermixed with black hairs on about the apex; hind femora gradually reddish yellow towards the top, covered with a rather dense brownish yellow tomentum leaving the apical thirds of the inner-lower side, bearing numerous short (but slightly longer than that on the middle pair) black pubescence except on the bare innerside at where there are pale short depressed rather inconspicuous hairs which becomes longer about the base, on the underside with a long (not very conspicuous) black fringe and on about the base of the dorsal side with a much longer conspicuous black tuft; fore tibiae darker about the apical third, clothed with numerous rather dense depressed very short black pubescence all over, but on the underside there is a few widely scattered inconspicuous touch-hairs; middle tibiae pubescent similarily to the front pair but the pubescence very slightly longer, with two unequal black spurs with the extreme base reddish; hind tibiae with two dorsal and one ventral short black fringes, the pubescence on the rest all shorter and black; tarsi black in the front pair, but the two posterior pairs reddish black obscured by numerous tiny black bristles which on the underside are reddish brown; claws shining black with the base yellowish red; pulvilli pale brownish orange.

Abdomen large, broader than the thorax and much longer than the head and thorax (including the scutellum) together, almost parallel-sided with a blunt apical margin, reddish brown. Dorsum gradually darkened apically with the last two segments blackish brown, with a rather narrow black median stripe which becomes slightly broader apically, and which is interrupted at the segmentations at where there

are very small yellowish haired median triangles except on the seventh segment, on each side there is also narrow less defined interrupted black stripe from the second to fifth segments and on the hind margins which cause the interruptation of the side stripe with conspicuously very small yellowish haired side flecks, the side stripe on the second segment broadened but quite obscured by a yellowish tomentum which extends up to on the large blackish lateral spots on the first segment; first segment with a rather large transverse black median spots; sixth segment with a very inconspicuous reddish spots on the outsides of the broad black stripe; pubescence on the rest short, depressed, and black, but that on the first segment becomes yellowish on just behind the sides of the scutellum, all the side-hairs longer and black but on the sides of the second segment intermixed with numerous whitish hairs. Underside only with the seventh segment blackish, covered with a much shorter black pubescence all over the surface but on the lateral hind margins of the segments from the second to the fifth there is more or less whitish rather conspicuous though still short pubescence; seventh segment covered with numerous long erect curved black bristly hairs; sixth segment at the sides and about the middle more or less blackish and covered with black pubescence all over.

Length: 23 mm.

Described from a single well preserved specimen from Okinawa Island (July). This species is somewhat allied to *Tabanus rubicundus* from Ceylon, but it is easily distinguished from the latter by its large size, by the somewhat brownish tinged face, by the distinct thoracal stripes, by the conspicuous black side-flecks, by the reddish brown ventral abdomen, and by the reddish tibiae. From *Tabanus fumifer, stantoni, indianus, brunneus, malayensis*, and *factiosus*, it is quite deffe-rent.

After having described the above description I have had a chance to travel in Oshima Island (Kagoshima-Ken), 10th-19th July in the year 1918, and collected a good long series of a species, which is

practical identical with *T. okinawanus*, but in minor point differs from that as follows :

Antennae yellowish-red to reddish brown or blackish ; the stripes on the thorax in some specimens very faint ; the median interrupted black stripe in a few specimens rather broad ; the wings more smoky but in the cells rather distinct narrow hyaline spots which sometimes disappear in the posterior cells.

T. okinawanus is only a recognized species in the Island of Oshima up to the present, and the female appears very abundant on the road through a pine-tree forest on a drizzly day, and also flies into houses built in a mountainous district in the evening, or sometimes it is attracted by light at night. The bite of the female was only a two day's matter to me, but I felt a very painful needle-puncture during the first day. This species may be not uncommon in Okinawa in July or June. The male is not known to us.

16. **Tabanus indianus,** Ricardo. (Pl. VI, fig. 1).

(Indo-Abu).

Rec. Ind. Mus., IV, p. 175, 1911 ; Ann. Hist. Nat. Mus. Nat. Hung., XI, p. 169, 1913.

A reddish brown medium-sized species with the narrow and long frontal callus (with a very long linear extension) on the narrow frontal stripe, with the very faint greyish stripes on the greyish brown thorax, with the rather small and narrow yellowish-haired triangular median spots on the reddish brown abdomen, and with the basal half of the front tibiae of the female distinctly pale yellowish white

Female. Head slightly wider than the thorax, about two-fifths as long as the thorax, moderately arched. Frontal stripe covered with brownish grey tomentum which becomes paler below and above, and with numerous short sloping black pubescence which is quite absent on the lower fourth and becomes slightly longer and more erect on

the vertex, very narrow, contracting (but not conspicuously) from the vertex to the frontal eye-angles, and about eight times as long as its narrowest part or about six and a half times as long as its broadest part; frontal callus blackish brown or reddish brown, shining, slightly convex, long and narrow, bearing an inconspicuous and intermixed median sulcus, separated from the eye-margins by a comparatively broad linear space and from the frontal triangle by a much broader interval, but its upper end with a longer linear extension which reaches above the middle of the frontal stripe and slightly keeled and sharply pointed above; vertex quite grey, with an indistinct very small elevation representing the ocelligerous tubercle; frontal triangle covered with a pale yellowish grey tomentum, slightly elevated from the eye-margins, and with a fine median sulcus, separated from the cheeks by the distinct and rather deep outwardly curved furrows which are not reaching to the eye-margins but connecting with the short but conspicuous sulcus along the eye-margins up and down the division between the frontal triangle and cheeks, on both the sides of the median sulcus with very faint ribs-like depressions. Face covered with pale yellowish grey tomentum which becomes paler on the epistoma and on the lower part, bearing a short scattered whitish pubescence with four or five black hairs intermixed near the upper outer corners of the epistoma; epistoma large, broader than the height, and its pubescence gradually growing up rather shorter and more sloping towards the mouth-edge; cheeks narrower than half the width of the epistoma, conspicuously narrowed above the lateral pits of the epistoma, rather conspicuously yellowish about the upper corners, and the pubescence on the upper parts rather shorter than that on the epistoma, but suddenly growing up much longer and denser, and greyer about the jowls; jowls moderately puffed up from the eye-margin but not much extent, the pubescence very slightly yellowish and extending up to the back of the head, where it becomes much shorter, very much sparser though scattered on the whole surface, and quite whitish; behind the narrow but broader than

that in *Tabanus abbreviatus* pale yellowish grey postocular bare rim, which becomes narrower than the upper eye-angle and about the outer eye-angle, there is a short brown ciliation and behind that a longer yellowish fringe is so conspicuous as one may sometimes almost say that the postocular ciliation is long and yellowish with some short brown bristly hairs intermixed. Proboscis dull brownish black, stout about two-thirds as long as the depth of the head; the stalk comparatively short, bearing long erect and rather stout blackish somewhat bristly hairs behind, and the sucker-flaps large and longer than the stalk, furnished with some shorter erect blackish bristly hairs. Palpi pale yellowish similar to those of *T. abbreviatus* but with rather pointed apex; basal joint short and cylindrical but slightly thickened apically, covered with some ashy grey tomentum and with long but shorter than that on the jowls pale yellowish grey pubescence which becomes shorter near top where a very few and tiny black bristly hairs exist; second joint long and slender, wholly three times as long as the first joint, stout about the basal thirds and then gradually narrowed to a point, and about four times as long as the broadest part, the outside obscured by dense tiny black bristles which become sparser before the base and are almost entirely wanting about the base, where there is some fine inconspicuous whitish pubescence. Antennae long and slender, and about as long as the palpi, reddish brown darker towards the apex; basal joint moderately large and long with the upper apical expansion being moderately long and broad, slightly obscured by whitish grey tomentum, and covered with numerous short black pubescence which grows up conspicuously longer about the lower apex; second joint quite reddish brown but somewhat obscured by whitish grey tomentum, smaller, longer than one-third the basal joint, with a long and narrow conspicuous process on the upper apical margin, and with a complete circlet of tiny black bristles about the top; third joint dull blackish or blackish brown with the base usually reddish, long and rather slender, about three times as long as its broadest part, gradually

widened from the base to just before the middle of the basal annulation and then rapidly scooped on the dorsal margin and gradually narrowed to a sharp point; the basal annulation of the third joint about one and an eighth times as long as its broadest part, where it has a large distinct tooth crowned with tiny black bristles, almost always dark brown with the base more or less reddish especially on the underside; the style-like portion wholly one and a half times as long as the basal annulation, dull black, with the three subquadrate basal annulations and the conical apical one, each of these annulations bearing one or two very tiny inconspicuous pubescence about the tip. Eyes large, with the facets practically equal in size, in death deep brownish black with a coppery shimmer, and without any markings or bands; when seen from above flat triangular with rounded outer angle, the upper angle about 100°, and the frontal angle about 60°, the inner margin about four-fifth as long as the hind margin which is very slightly curved, and the outer margin rather strongly curved outwards about the posterior half; in profile rather oval, with moderately forwardly curved frontal margin and strongly downwardly curved lower margin; when seen from the front about as wide as deep, the frontal angle wholly 135°, the lower angle about 120°, the upper angle about 95°, and the outer angle evenly largely rounded.

Thorax large, oval, somewhat narrowed towards the anterior part, brownish black, obscured by a greyish tomentum, with three narrow median and two broad lateral stripes very faint of which the middle one is narrowest and not extending to the posterior border, and the side pair is slightly broader and conspicuous and reaching to hind margin just insides the postalar calli, these three median stripes being yellowish grey of which the outer two are bent outwards and connected with the lateral stripes on the suture and they have a fine brown stripe in the middle throughout the whole length, while the lateral stripes are very broad about apical half and somewhat ashy grey

throughout but interrupted by a large triangular brown praealar callus, and their posterior halves are much narrower and on the insides there is a rather broad but very faint brown stripe from near the upper angle of the praealar callus to the postalar callus ; pubescence on the disc very numerous, depressed and pale yellow, intermixed with numerous a little longer suberect black hairs which become more longer and paler about the anterior vertical part ; humeri rather large yellowish brown but obscured by ashy grey tomentum, and covered with long pale pubescence which on the upper part is intermixed with a few short black hairs curved above ; praealar calli almost wholly ashy brown but slightly yellowish about the upper angle, covered with numerous stout upturned black pubescence which becomes conspicuously longer and much bristly on the lower part and is intermixed with yellowish hairs similar to those on the disc ; the space between the humeri and the praealar calli conspicuously greyish continuous with the first, bearing numerous long pale yellowish grey pubescence with some stouter black hairs intermixed near the postero-lower part ; just above the wing-bases and on the posterior margins of the postalar calli there are long conspicuous pale yellowish white tufts, and on the rest of the latter they covered with an abundant sloping black pubescence ; scutellum triangular with a rounded posterior margin, black obscured by a grey dust, and bearing numerous short yellowish pubescence with abundant stout sloping black hairs intermixed, and on the posterior extremity there is an inconspicuous but moderately long and numerous pale yellowish fringe. Pleurae obscured by a dense ashy grey tomentum with slight yellowish tinge, and covered with numerous somewhat long pale yellowish white pubescence which becomes somewhat conspicuously white near the bases of the front and middle legs on the sternopleurae and grows up a little longer and denser on the upper part, and which is intermixed with some conspicuous black hairs on the postero-upper part of the mesopleurae ; on the prothorax and on the upper margins of the meso-, meta-, and ptero-pleurae there are longer pale yellowish grey

tufts. Wing as long as the thorax and abdomen together, slightly greyish, and faintly tinged with yellowish brown on the fore border and along the veins, with the stigma yellowish and with the veins brown but the basal parts of the radial and postical veins more or less yellowish; all posterior cells open but the first one conspicuously narrowed at the opening, discal cell very large and much longer than the second posterior cell, and anal cell closed some distance before the wing-margin; upper branch of the cubital fork with no recurrent veinlet; the rounded hyaline spot near the discal cell on the stem of the discal fork, and the hyaline portion of the marginal cell, conspicuous and rather large. Squamae in the alar pair glassy grey with dark brown margin and rather dense and short brown fringe excepting of a long conspicuous yellow tuft about the angle, in the thoracal pair pale brownish with brown margin and sparse pale yellowish brown fringe. Halteres reddish brown with paler knobs.

Legs blackish to reddish brown, with the extreme apices of all femora, and with mostly part of the three tibial pairs paler; front coxae moderately dilated and about two-thirds as long as the front femora, clothed with dense whitish grey tomentum and covered with long pale greyish white pubescence which becomes shorter towards the apex where is a some very short brown pubescence; front femora very slightly dusted with greyish, bearing numerous sloping blackish pubescence which becomes yellowish and much erect on the outside especially about the basal two-thirds; the shining subfemoral space rather broad, rather strongly grooved throughout the whole length and inconspicuously transversely striolate, behind which a black ciliation is rather short but rather dense; middle femora covered with numerous short sloping black pubescence which is very slightly intermixed with yellowish hairs on the apical part, and bearing long yellowish outer and ventral fringes of which the latter is less conspicuous and is intermixed with some black hairs on the apical half; hind femora covered with short yellow rather depressed pubescence which

is densely intermixed with a little longer and stouter black hairs all over the dorsal and outer sides, and there is some long sparse yellowish tuft about the upper basal part and is a long conspicuous yellowish ventral fringe; front tibiae not dilated but very slightly curved, less than apical half black or blackish and the rest pale yellowish with the underside pale reddish yellow or reddish orange, covered with dense short depressed white pubescence on the upper half of the paler portion and with yellowish one on its under surface, bnt on the blackish portion entirely black, the black pnbescence very sparsely extending up to the base along the upper yellowish surface; middle tibiae about apical third or fourth brownish, covered with short but stout yellow pubescence on the paler portion and with similar but black one on the darker portion, this black pubescence extending up to the base along the upper side; the spurs of this tibiae dull blackish, unequal, and moderately long; hind tibiae coloured and haired as in the middle pair but usually darker owing to that the two (outer and inner) dorsal black fringes are conspicuous; tarsi all black or blackish brown, especially in the fore pair much deeper, the two posterior pairs with reddish soles; pulvilli pale orange, and claws black with the base yellowish brown.

Abdomen wholly as long as the head and thorax (including the scutellum) together, broader than the thorax about the base and then gradually narrowed to an obtuse apex. Dorsum reddish brown or yellowish brown, with the extreme hind margins of the segments furnished with short yellow pubescence, excepting of the basal and apical segments, the median pale yellowish white haired triangles are present from the second to fifth segments, with the traces on the first and sixth segments, their apices almost reach the anterior border of each segment, and the sides of these triangular spots are more or less darkened; pubescence on the rest dense and depressed black, which becomes much denser at the apex, and which is inconspicuously intermixed with similar but yellow hairs on the posterior halves of the

sides of the median triangles on the first to fourth segments; the sides of the basal two segments broadly paled and covered with paler and longer pubescence, those of the remaining segments more or less paled and furnished with yellow pubescence. Ventre paler than the dorsum, with the posterior part much paler but the large median part conspicuously darker partly owing to that it is covered with tiny black pubescence; pubescence mainly pale yellowish white especially on the hind margins of the second to sixth segments conspicuously yellow, but intermixed with black hairs about the large median area or almost whole the surface; the seventh segment furnished with stout and long curved black bristly hairs almost all over the surface.

Length: 18-20 mm.

Male. More slender than the female, and much redder in colour, the median spots on the abdomen are smaller and the fore tibiae dull yellowish or obscurely red at the base with only a few lighter hairs.

Head larger than in the female, being so much more rounded anteriorly that it forms almost a semicircle, and slightly broader than the thorax. Frontal triangle flat, rather smaller and sharply extending up between the eyes, covered with pale yellowish tomentum, which is quite absent about the upper third where is dull reddish brown, the median sulcus distinct on the lower half, this triangle separated from the cheeks by distinct and deep but very fine sulcus which is hardly reaching the eye-margins. Face rather small, clothed with dense yellowish grey tomentum which becomes paler on the epistoma; cheeks broad and moderately inflated, almost equal in width throughout, covered with rather dense soft pale brownish yellow pubescence which grows up considerably longer and shaggier and much deeper clour on the jowls, and then extends up a little to the back of the head; epistoma quite sunken as usual, bare from pubescence. Back of the head hollowed out especially about the upper half, with a very fine inconspicuous yellowish postocular bare rim which is nearly absent on the upper part,

and behind which there is a very short indistinct dark brown ciliation of somewhat stout bristly hairs and behind that is a long (still short) rather conspicuous yellowish fringe, the former one extending just before the vertex and in that part its basement is rapidly broadened, while the latter becomes sparser and less conspicuous about the upper part. Proboscis slender and longer than the female but still shorter than the depth of the head, brownish black, bearing abundant pale yellowish white pubescence behind the stalk and furnished sparse short brownish hairs on the underside of the sucker-flaps which are stout and about half as long as the proboscis. Palpi very short and orange yellow; first joint short but cylindrical, slightly obscured by grey tomentum on the outside, covered with abundant long (but much shorter than that on jowls) yellowish pubescence; second joint less than twice as long as the basal joint, slightly dilated apically, and then suddenly narrowed to a large blunt point, covered with numerous comparatively long yellowish pubescence which is intermixed with a very few scattered shorter black hairs on the outside of the apical half, and at the extreme top there are some dense very short black bristly hairs which are mostly directed below. Antennae as in the female, but almost usually paller. Eyes large, touching for about the middle five-seventh, in view seen from the above triangular with outwardly curved out margin, the hind margin about as long as the frontal margin and very slightly curved inwards near the outer end; in profile somewhat triangular, with very slightly outwardly curved frontal and facial margins and convex hindmargin, and with the frontal angle about 110° and slightly rounded; when seen from in front much deeper than the width, the frontal angle wholly 145°, the lower angle about 100°, the upper angle less than 80°, and the outer angle evenly rounded; facets on about the upper two-thirds being all very much enlarged and strongly contracted with the small facets on about the lower third and on the narrower margin zone; the enlarged facets extend undiminished up to the touching part of the eyes; the rather conspicuous line of

separation begins near the top of frons and is hardly undulating but runs nearly straight across the eye to the narrow zone, leaving the widest part of the small facets at about the middle of the head (when viewed sideways); the narrow zone extends right up to the vertical space at where it bends anteriorly a short distance from the vertex along the frontal margin, and is very slightly narrowed above, and its vertical dividing line is not so conspicuous as the horizontal one; eyes in death deep greenish black with a shimmer on the part of small facets, but the large facets yellowish brown, and there is no bands.

Thorax rather browner than in the female and with rather longer much abundant erect blackish pubescence, and with much less yellowish depressed pubescence, the tufts on the upper bases of the wings and on the posterior margins of the postalar calli are less conspicuous and yellowish red, the long pubescence on the spaces between the humeri and praealar calli are much longer and very yellowish. Scutellum usually shorter and evenly rounded posteriorily, with much longer much abundant erect blackish pubescence, and with a less abundant pale marginal fringe. Pleurae covered with much abundant more longer and much yellowish pubescence, and with reddish yellow tufts on the postero-upper margins of the meso- and meta-pleurae, the tufts on the prothorax and on the upper margin of the pteropleurae are less conspicuous, the former being yellowish and the latter reddish.

Wings, squamae, and halteres almost as in the female, but the former comparatively shorter, and the next much glassy especially in the alar pair.

Legs much darker than those in the female; pubescence on the front coxae yellow; the front tibiae brown, gradually darkened apically, covered with black pubescence all over the surface, but with very few reddish yellow hairs intermixed about the basal third, posterior two pairs much darker owing to that the hairs almost all are black with a very few reddish yellow pubescence intermixed on about the basal two-thirds especially on the underside; femora similarly coloured as

those in the female but with much brownish appearance as all the pale hairs are yellowish brown or yellowish red, the middle femora bearing a rather long conspicuous black fringe on the inner side.

Abdomen much slender and redder than in the female, the median triangles smaller and almost usually not extend up to the anterior margin of each segment, but on each of the second and third segments there is a narrow though conspicuous and well-defined blackish stripe from the anterior margin to the top of the triangle, these short blackish stripes being not conspicuous in the female owing to the blackish tinge on the sides of the median spots; pubescence on the dorsum and the ventre similar to that in the female, but the darker median part much narrower than in the female.

Length: 19-22 mm.

This species in appearance is allied to *Tabanus exoticus*, Ricardo, and *T. trigonus*, Coquillett, but easily distinguished from the both, by the abdomen with no conspicuous broad yellowish hind margins; and it may be distinguished from the allied species in the world, by the distinct pale yellow fore tibiae with white hairs of the female, and by the longer narrow white-haired triangular median spots of the abdomen.

T. indianus is not very common throughout the Island of Formosa, and its occurence is probably restricted to the southern parts, as I have an actual record from Takao only: it is also known that this species occurs in India. It is noticed that the female bites cattle and buffaloes in the day time, in Formosa.

This fly varies but little in the amount of the blackish colouring sometimes surrounding the median abdominal spots in the female, and in the distinctness of the short black stripes on the second, thirds, and fourth abdominal segments in the male; as well as in the both sexes, in the amount of the colouration of the first posterior cell of the wings, and in the darkness of the colour of the antennae and legs.

17. Tabanus sapporoenus, Shir. (n. sp.) (Pl. VII, fig. 3; Pl. XI, figs. 5 & 6).

(O-Aka-Abu, or Aka-Abu).

Tabanus rufidens (Bigot) Matsumura, Thous. Ins. Japan, II, p. 70, pl. XXII, fig. 1, 1905; 大日本害蟲全書,後編, p. 72, pl. X, fig. 13, 1914.

Rather large blackish grey species, with the densely golden-yellow haired abdomen which more or less bears some black or brownish black pubescence on the median part of each dorsal and ventral segments respectly, with the broad parallel-sided frontal stripe and the large castaneous black frontal callus, with the large pointed tooth of the third antennal joint, with the yellowish wings and with the blackish brown legs excepting of all the tibiae dirty yellow.

Female. Head as wide as the thorax and about a half as long as that. Frontal stripe greyish yellow, slightly darkened above, broad, parallel-sided, about three and a four-fifth times as long as it is broad, covered with numerous but not dense short sloping black pubescence which does not extend below, and on the lower thirds there are some very fine pale inconspicuous hairs; frontal callus shining castaneous but about the margin blackish, quite separated from the eye-margin, somewhat rounded, with a rather broad linear black upper extension which extends beyond the middle of the whole length of the frontal stripe; vertex slightly darker but obscured by a grey tomentum, with the very inconspicuous traces of the ocelli and bearing dense short rather depressed black pubescence, behind which is some still short outstanding blackish hairs. Frontal triangle broad and short, rather flat, covered with a pale yellowish grey tomentum but there is an irregular transverse narrow distinct blackish spot on each side of the upper margin, with the rather broad orange yellow tomentose double lunules just above the antennal sockets, and with a fine though distinct median sulcus which does not reach the base of the frontal callus. Face moderately convex, covered with a greyish yellow tomentum; epistoma very slightly tinged with pale brownish grey about the upper

lateral corners at where it bears numerous dense somewhat long pale brownish yellow hairs, while on the rest there is almost no pubescence; cheeks narrower than the half of the epistoma, covered with abundant short yellowish pubescence which becomes slightly longer but sparser towards the inner sides, and which grows much longer and more conspicuous below on the jowls and extends a little up to the back of the head; back of the head rather shallow on the lower part and hollowed out above, covered with a greyish yellow tomentum and scattered pale brownish yellow soft hairs all over the surface, the dividing line between the occiput and the back of the head very distinctly black, the postocular bare rim greyish yellow, narrow and much narrowed about the temple region, behind which is a conspicuous dense brownish yellow ciliation which extends below the jowls but not on the vertex. Proboscis blackish, rather stout with the large sucker-flaps which are about two-thirds as long as the proboscis and bear scattered blackish bristly hairs beneath, while the stalk is covered with a yellowish grey tomentum behind and with numerous brownish hairs there. Palpi slender, reddish yellow; basal joint largely parts blackish beneath, but obscured by a yellowish tomentum, covered with numerous long pale brownish yellow pubescence and at the apical part of the outside there are some shorter though stouter black hairs, this joint about fourth as long as the end joint; second joint wholly five times as long as its broadest part, thickest near the base and then drooping and gradually narrowed to a blunt top, clothed with numerous rather dense tiny depressed black bristles all over the outside and about the base of the underside there is a very few inconspicuous thin pale pubescence, while the inner side is almost quite bare. Antennae reddish brown with the apical two-thirds of the third joint and the upper apical part of the first joint more or less blackish; basal joint longer than its thickest part, gradually thickened towards the apex where the above is hooked over the base of the second joint, covered with numerous short depressed black pubescence which becomes sparser about the base

and below, except on the narrow under margin bare, but its apex with a few longer black pubescence; second joint small and about a half as long as the basal joint, with a rather broad above apical process, covered with numerous tiny black pubescence which becomes scarce towards the base and disappears on the inner upper narrow margin; third joint longer than the twice of the basal two joints together, the basal annulation very broad and about one and a half times as long as its broadest part at where it bears a rather long and large dorsal tooth (just before the middle) crowned with two or three tiny black bristles, and its lower margin moderately bent beneath at before the middle; style-like portion about a half as long as the basal broad annulation, with the basal three annulations somewhat transverse of which the middle one is shortest, while the top annulation is rather short conical with the blunt point and is not very much longer than the preceding one, each annulation bearing one or two very inconspicuous fine pubescence about the top. Eyes bare, with the facets all equal, in death deep greenish black; when seen from above the hind margin nearly straight and about one and a half times as long as the frontal margin, the top angle about 105°, and the frontal angle about 80° but the outer margin not much convex; in profile somewhat regular oval, narrowed above, apparently deeper than long; when seen from in front slightly wider than deep, the facial margin very slightly convex and slightly shorter than the frontal margin, the frontal angle about 135°, and the top angle about 100°.

Thorax rounded, very slightly longer than width, blackish, obscured by a pale yellowish grey tomentum, and covered with numerous very short depressed yellowish pubescence intermixed with abundant still short erect black hairs which are replaced by numerous longer pale soft hairs on the anterior vertical part, with three somewhat distinct narrow greyish yellow median stripes and a pair of similar but much broader and more inperfect lateral stripes, of which the middle one is narrowest and only extending beyond the suture and the next

pair hardly reach to the hind margin, while the lateral pair are quite interrupted by the praealar calli after which they becomes suddenly narrow and more inconspicuous; humeri pale somewhat brownish, densely clothed with a grey tomentum and bearing numerous long pale brownish yellow hairs; praealar calli reddish black, obscured by a grey tomentum, the upper half bearing rather scattered short but stout black hairs directed variously and intermixed with more short yellow hairs, and the lower half furnished with numerous long erect conspicuous black hairs forming a distinct lateral fringe which does not extend forwards from the calli, but on the space between the humeri and then there are numerous long dense erect pale brownish yellow hairs; postalar calli reddish yellow, obscured by a greyish tomentum and covered with short black and yellowish hairs, and on the postero-outer margin there is a dense somewhat long pale yellowish grey tuft, the similar but shorter tuft on about the pale reddish brown wing-base; pleurae paler than the thorax, covered with a greyish yellow tomentum and numerous moderately long pale brownish yellow soft pubescence which on the posterior part of the mesopleurae is intermixed with some short but stout black hairs, prothorax and pteropleurae covered with very long pale brownish yellow hairs, and on the postero-upper margins of the meso- and meta-pleurae are long pale brownish yellow tufts. Scutellum similar to the thorax, but on the margin there is a rather short but somewhat dense pale brownish yellow fringe.

Wings very slightly shorter than the thorax and abdomen together, slightly tinged with brownish yellow, with the veins brownish and with the stigma dull yellow; costal cell yellow, all posterior cells widely open but the first one very slightly contracting towards the margin, discal cell moderate in size and apparently longer than the first posterior cell, and the anal cell closed with a long petiole. Squamae in the alar pair dark grey with a yellowish brown margin and a pale brownish yellow ciliation except the long pale fringe about the angle, in the thoracal pair yellowish brown with a reddish brown margin and

a whitish yellow ciliation. Halteres comparatively small, dark brown with the top of the knob yellowish grey.

Legs dark brownish with the tibiae almost all dull yellowish; front coxae dilated, about two-third as long as the fore femora, covered with a yellowish grey tomentum and numerous long pale brownish yellow pubescence which is intermixed with a few short blackish hairs about the top; fore femora blackish, obscured by a yellowish grey dust leaving a rather broad shining castaneous black subfemoral bare space which is transversely striolate and is hollowed out about the apical third, on the inner margin of this bare space with a very short dense black ciliation, the outside with a long dense erect pale brownish yellow fringe, the pubescence on the rest short, depressed, and pale brownish yellow; middle femora reddish brown but slightly darker towards the base and especially on the underside blackish, slightly covered with a yellowish grey dust and clothed with abundant pale brownish yellow pubescence which on the inner side is intermixed with short black hairs and on the outside becomes longer as one may describe that the middle femora bare a somewhat long outer fringe, while on the underside there are numerous much longer black hairs about the basal third; hind femora in colour similar to the preceding pair but more darker, the pubescence almost all pale brownish yellow, becoming longer on the basal part of the dorsal surface and on the underside throughout, and intermixed with some black hairs about the base especially on the outside; front tibiae at the apex dark brown, covered with numerous short depressed pale brownish yellow pubescence which is intermixed with some scattered still short black hairs on the underside, but on all the apical part only with black hairs, the touch-hairs on the underside black and very few; middle and hind tibiae very slightly brownish at the apex, covered with numerous short pale brownish yellow pubescence intermixed with some short black hairs about the tip, the unequal spurs of the middle tibiae rather small and yellowish brown with the top more or less blackish, the pubescence on the dorsal sur-

face of the hind tibiae hardly forming two fringes; tarsi blackish brown but the front pair nearly black, covered with dense short black bristles, the soles of the two posterior pairs yellowish red, the touch-hairs of the first pair rather conspicuous; claws all shining black, with the base reddish; pulvilli dull brownish yellow; the pale brownish yellow pubescence on the legs all with some golden yellow shimmer in a certain light.

Abdomen longer than the head and thorax (including the scutellum) together and broader than the thorax, with the apex moderately flat and roundish. Dorsum in appearance deep orange yellow with the blackish median stripe bearing small greyish yellow triangles; dull brownish red, with the apical four segments black, the basal segment broadly blackish about the basal half and the sides, and the following two segments with a narrow black median spot extending from the front margin to near the hind margin and with irregular unwell-defined blackish lateral spots, all the segments very densely clothed with short depressed golden yellow pubescence all over the surface except on the moderately broad median line which is covered with similarly short but black hairs, but on the posterior border of each segment there is a somewhat distinct but small pale yellowish haired triangle which is not conspicuously appeared on the first segment; the second, third, fourth, and fifth segments on about the anterior lateral disc with a very few scattered inconspicuous black pubescence intermixed; the pubescence on the sides longer and golden yellow; the golden yellow pubescence on the dorsum when seen from some directions brownish yellow. Underside blackish brown, when seen from behind the median part rather broadly more or less shining throughout all the segments, at where it bears short depressed blackish hairs, the pubescence on the rest all golden yellow as that on the dorsum but less dense and more short; second segment with a few long erect pale brownish yellow pubescence on the basal median part, and the seventh segment with some long erect stout blackish bristles.

Length : 24–24.5 mm.

Described the above from three well preserved female-specimens, taken by Prof. Matsumura at Maruyama near Sapporo, on the 10th of August in the year 1902.

This species is somewhat allied to *Tabanus bovinus*, Loew, from Europe, but it is easily distinguished from that by the large dorsal tooth of the third antennal joint, by the more greyish thorax, by the longer and more tawny coloured abdomen which is covered with more conspicuous golden yellow pubescence only leaving a median blackish stripe, by the more yellow tinged wings, by the more abundant black pubescence on the legs, and by many other points as described already; there is no allied species in our horse-flies. *T. sapporoenus* is a blood sucker, biting cattle, but I have no other knowledge of its habits.

I do not believe that this species I have now described is the same as Prof. Matsumura has recorded as *T. rufidens*, Bigot, but I am convinced that it is a valid new species, for I have rather a long series of the species quite agreeing Loew's description of *rufidens*, and also I can not find that there is any allied species in the world.

18. **Tabanus mandarinus**, Schiner. (Pl. VI, figs. 4 & 5).

(Shirofu-Abu, or Ko-Shirofu-Abu)

Reise der Novara, Dipt., p. 83, 1868.

V. d. Wulp, Cat. Dipt. South Asia, p. 61, 1896.

Kertesz, Cat. Dipt., III, p. 259, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 170, 1911; Ann. Hist. Nat. Mus. Nat. Hung. XI, p. 169, 1913; Suppl. Ent., III, p. 64, 1914.

Tabanus amaenus, Matsumura, 大日本害蟲全書, 後編, p. 70, 1914 (*T. trigeminus*).

Tabanus trigeminus, Coquillett, Proc. U. S. Nat. Mus., XXI, p. 310, 1898.

Kertesz, Cat. Dipt., III, p. 287, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 170, 1911.

Shiroki, Tokubetsu-Hokoku, Exp. St. Govern. of Formosa, VIII p. 282, 1913.

Matsumura, Thous, Ins. Japan, II, p. 72, pl. XXII, fig. 3, 1905

臨時馬疫調查委員會研究成績（馬政局）第二稿, pl. VI, fig. 3 1914.

? *Tabanus yokoamensis*, Bigot, Mem. Soc. Zool. France. V, p. 678 1892.

A blackish medium-sized species with an oblong blackish frontal callus which has a darker linear extension on the moderately narrow frontal stripe, with five distinct grey stripes on the thorax, with three grey spots on the first two or three segments only, and with the conspicuously pale tibiae.

Female. Head slightly broader than the thorax, rather short, and moderately arched. Frontal stripe narrow, very slightly contracting from the vertex to the eye-angles, and wholly six times as long as its narrowest part or wholly five times as long as its broadest part, with two somewhat distinct longitudinally oblique sulci from about the middle of the eyemargins to below the vertex, not connecting with one another at the upper ends, clothed with pale yellowish white tomentum which has a light shimmer (when seen from above) and is brown (when viewed from below), and which is yellowish about the lower half (when seen from front); pubescence on the frontal stripe sloping, pale yellowish white, with some similar but blackish hairs intermixed on more than the upper half, which become much numerous on the vertex, while the pale hairs are nearly disappeared there; frontal callus slightly elevated, reddish black or black, oblong, not reaching the eye-margins and hardly touching the frontal triangle, with a long linear extension which is more convex than the callus proper and is about twice or three times as long as the broadest portion, and with a very fine somewhat distinct longitudinal median sulcus; frontal triangle moderate in size, slightly convex, pale

yellowish grey, with a conspicuous median sulcus and a pair of very faint oblique furrows, the latter being nearly parallel with the eye-margin and very rarely crossed by two or three short ribs-like furrows. Face similarily dusted with pale yellowish grey as the frontal triangle, convex as usual, and with the rather deep conspicuous black lateral pits, covered with abundant but not dense moderately long whitish pubescence which is conspicuously numerous on the upper lateral corner on the epistoma and on the cheeks, while the median part of the former bears much sparser sloping hairs with a very few blackish pubescence intermixed; jowls more inflated than the cheeks, covered with dense conspicuously longer and shaggy whitish pubescence which hardly extends up to the back of the head where there is a few scattered short whitish pubescence; the greyish bare postocular rim rather narrow, unequal in width throughout, very inconspicuously narrowed near the vertex and rather distinctly narrowed about the outer eye-angle, and behind which is a short yellowish brown ciliation which becomes slightly longer and much paler on the upper part and extends below to the hind upper part of the jowls. Proboscis stout and wholly two-thirds as long as the depth of the head, blackish brown, covered with abundant somewhat long whitish pubescence behind the stalk which bears slightly longer yellowish tuft; sucker-flaps large and about two-thirds as long as the whole length of the proboscis, furnished with some scattered short brown bristly hairs. Palpi dull yellow or pale reddish yellow, long and slender; first joint somewhat cylindrical, about thirds as long as the second joint, obscured by dark grey tomentum and covered with numerous long and shaggy pale yellowish white pubescence similar to that on the jowls; second joint narrow and about four times as long as the width of the stout part, only moderately dilated about the basal half but then drooping and gradually diminishing to a blunt point, clothed with tiny black bristles all over the upper and outer sides except the basal part at where there is a few longer thin pale hairs especially on the underside. Antennae usually blackish with

the basal part of the third joint reddish brown or reddish yellow; the basal joint short and cylindrical, slightly thickened towards the apex which has a conspicuous broad expansion pointed apically on the dorsum, slightly covered with a greyish tomentum and densely clothed with short black bristles which become much shorter and sparser about the base and on the underside, and which are intermixed with some longer thin whitish hairs on the under and outer sides; second joint very small, about thirds as long as the basal joint, and with a rather long spine-like dorsal process on the apical margin, less obscured by a greyish tomentum, and bearing a rather complete black circlet of tiny inconspicuous black bristles which grow up a little longer on the underside; third joint rather broad and short, but slightly longer than twice the basal two joints together, moderately paler than the latter with the basal part conspicuously or faintly reddish; basal annulation of the third joint very wide, about one and a sixth times as long as its broadest part, and about one and a half times as long as all the following annulations together; the dorsal tooth a little before the middle, very large and conspicuous, crowned with a few stout and very short conspicuous black bristles; the style-like portion usually dull coloured, and bearing one or two very minute pubescence about the apices of the annulations of which the apical one is somewhat conical and is about one and a half times as long as the basal three, while the basal annulations are subquadrate. Eyes moderate in size, when seen from above the frontal margin about two-third as long as the hind margin which is very slightly curved and with the frontal margin is forming an angle about 100°, and the outer margin moderately and evenly convex; in profile rather irregular oval; when seen from front deeper than the width, the frontal angle about 140°, the upper angle about 90°, the lower angle about 135° and somewhat rounded, and the outer angle strongly rounded, the frontal margin apparently longer than the facial margin; in death deep purplish black with a coppery shimmer.

Thorax stout and short, slightly narrowed apically. Dorsum brownish black but obscured by a greyish tomentum, with five rather distinct yellowish grey or grey stripes of which the middle one is narrowest and gradually widened posteriorily, the outer two are broader and slightly thickened at the suture after which they are slightly oblique inwards and fused with the median stripe together and extend to the posterior margin at where the median one separated by a brown triangle into two laterals, this brown triangle extending up to near the level of the suture, while the side stripes are broadest and extend from the humeri to the postalar calli passing over the praealar calli, and they are divided into two narrow stripes by a narrow and short conspicuous brown stripe from the postero-upper margin of the praealar callus to the anterior margin of the postalar callus; pubescence on the disc numerous and depressed, yellowish, intermixed with abundant short and erect black hairs which become somewhat longer and paler at the apical part; humeri mostly covered with whitish pubescence but on the upper part there are some darker hairs; praealar calli bearing suberect yellowish pubescence with stout black bristly hairs intermixed all over the surface; pubescence on the space between the humeri and praealar calli longer than the disc and almost all suberect but near the suture there is somewhat depressed yellow pubescence; just above the wing-bases and on the postero-outer margins of the postalar calli there are long somewhat conspicuous greyish tufts of which the posterior one is more conspicuous and much longer; scutellum short and transverse with rounded posterior margin at where the pubescence is mostly pale yellowish forming a more or less distinct fringe, the pubescence on the rest of the scutellum numerous and black with some yellowish hairs intermixed. Pleurae obscured by a grey tomentum but more or less tinged with yellowish especially on the upper part, covered with long and rather dense whitish pubescence which becomes slightly longer and much denser and is rather greyish on the upper part, and on the mesopleurae there are some long blackish hairs scat-

tered all over the upper half; the prothorax bearing longer and shaggy whitish hairs, and on the posterior margins of both the meso- and meta-pleurae there are long dense shaggier conspicuous greyish tufts.

Wings clear but more or less tinged with yellowish, which are brown but with the basal part of the radial and postical veins and with the stem of the cubital fork more or less yellowish; the stigma yellowish brown; first posterior cell very narrowly open but sometimes closed with or without a short petiole, the other posterior cells widely open and never contracting at the wing-margin; discal cell moderate in size and very slightly longer than the second posterior cell, the anal cell closed a long before the wing-margin; upper branch of the cubital fork without any recurrent veinlet. Squamae in the alar pair glassy grey with a dark brown margin and a rather dense conspicuous brown fringe except for a long pale yellowish tuft about the angle, in the thoracal pair pale brownish with a brown margin and a rather sparse yellowish brown fringe. Halteres reddish brown or brown with paler apex of the knob.

Legs blackish, with the basal half of the front tibiae and the basal two-thirds of two pairs of the posterior tibiae dull yellowish, and with the extreme apices of the femora inconspicuously yellowish brown; front coxae moderately dilated and less than the two-thirds of the front femora, covered with grey tomentum and with numerous long whitish pubescence which grows up shorter at the apical part; front femora on the outside very slightly covered with greyish tomentum and conspicuously clothed with numerous long whitish pubescence which is intermixed with a very few scattered blackish hairs, the shining subfemoral bare space moderate in width, rather conspicuously transversely striolate and hollowed out about the apical half or less, and behind which is a short but quite conspicuous black ciliation throughout the whole length of the femora; two posterior pairs of the femora covered with greyish tomentum and with numerous but not dense pale yellowish white pubescence which is shorter than that in

the front femora; front tibiae not dilated but slightly curved as in the typical *Tabanus*, short pubescence on the whitish portion (which is slightly brownish on the underside) white and on the blackish portion black, the black pubescence more or less scattered on the former one; two posterior pairs of the tibiae slightly brownish on the underside of the paler portion, covered with short white pubescence which becomes suddenly black on the apical blackish part and which is intermixed with very few inconspicuous black hairs near the blackish part, and the hind femora bearing a long conspicuous whitish outer-dorsal fringe with some black hairs intermixed and a less long and less conspicuous inner-dorsal fringe of numerous whitish hairs intermixed with some black ones which are rather more abundant than in the outer fringe; the spurs of the middle tibiae unequal, rather small and brownish with the base reddish yellow; tarsi dull black, of which the posterior two pairs have the reddish soles; pulvilli yellowish brown, and the claws reddish brown with the apical half black.

Abdomen moderately, flat, broader than the thorax but the apical part moderately narrowed, and a little longer than the head and thorax (including the scutellum) together. Dorsum black, with a continuous row of the large well-defined ashy grey tomentose triangles from the first segment to the sixth segment, and on each of the basal two or three segments there is one pair of similar but less ashy grey oblique lateral triangles which are hardly reaching the anterior margin of the segment but on the second segment sometimes broadly connected with the precedings; the hind margin of each segment more or less dusted with grey especially on the second to third or fourth segments conspicuous, these greyish bands gradually narrowed towards the apex; the sides of the segments all covered with ashy grey (less denser than in the middle triangles) tomentum, especially on the first segment so conspicuous as there are the large roundish grey side-spots; pubescence very short, dense, black, but on all the grey parts pale yellowish white. Ventre densely covered with ashy grey tomentum, and with short, fine,

and whitish pubescence which becomes slightly longer and suberect and pale yellowish grey or blackish on the rather broad middle part; the seventh segment furnished with abundant long erect and covered with black bristly hairs.

Length: 16-19 mm.

Male. Almost like the female. Head much larger than that of the female; frontal triangle narrow with a sharp pointed expansion above, yellowish grey but dull brown about the upper third, flat, with a narrow distinct longitudinal median sulcus which becomes very faint or is sometimes altered by a faint carina on the dark portion, and with two or four oblique or transverse very vague furrows on the greyish portion; face uniformly dusted with yellowish grey, bare on the small triangular sunken epistoma but with long (though comparatively short) fairly dense and fine greyish yellow pubescence on the inflated cheeks; pubescence on the lower part of the cheeks, at the back of the mouth, and on the jowls much longer and pale greyish yellow (almost whitish); back of the head conspicuously hollowed out and covered with numerous but scattered whitish pubescence, with a very narrow yellowish grey postocular rim which at the temple region is practically sunk behind the eyes, and behind which is a very short very inconspicuous brownish yellow ciliation which hardly grows longer near the top angle of the eyes and which has absolutely no long overhanging or outstanding hairs, but in some lights the short ciliation on the temple regions is almost whitish; vertex slightly raised, very small, hardly extending lower down between the eyes, brown or dark brown, and behind which is some rather dense short yellowish brown pubescence which is longer than that of the postocular ciliation. Proboscis narrower than that in the female, on the posterior side the stalk covered with numerous long pale yellowish white pubescence which becomes more yellowish on the apex of the stalk, the sucker-flaps about half as long as the whole length of the proboscis and furnished with some short (less conspicuous than in the female) brownish pubescence. Palpi pale

yellow or sometimes yellow, a little longer than the half of the proboscis; basal joint oblong, longer than the half of the second joint, with a slight blackish grey tinge except at the tip, and clothed with long (but shorter than that on the jowls) thin pale yellowish grey pubescence; second joint oblong ovate, bladdery, about twice as long as its thickest part which is in a little before its middle, and ending in a rather sudden blunt conical or sometimes evenly rounded tip, and usually with a slight compression beneath just before the tip, widely clothed on its outer part with long (but shorter than that on the basal joint) soft thin whitish pubescence which is intermixed with shorter but stouter blackish hairs on about the apical two-thirds of its lower part, especially at the tip very conspicuous. Antennae dull orange red or rather darker; basal joint stouter and shorter than that in the female, covered with dark grey or greyish tomentum, much thickened apically, but bearing similar pubescence; second joint usually much paler or sometimes quite yellow, with a narrow dorsal apical process which is usually longer than that in the female, and with more conspicuous black circlet about the apex; third more slender, with the basal annulation about twice as long as its broadest part, and with the style-like portion about four-fifths as long as the broad basal annulation, the dorsal hump being less crowned with black bristles. Eyes quite bare, very much larger than that in the female broader than the thorax and about as broad as the broadest part of the abdomen, and about four-fifths as long as the thorax (not including the scutellum); when seen from the above triangular with the evenly rounded outer margin, the frontal margin as long as the hind margin which is very slightly curved inwards about the middle; in profile somewhat irregular trapezoid, with nearly straight frontal margin and with very slightly outwardly curved facial-, buccal-, and hind-margins, the hind angle most blunt and rounded, the lower angle about 100° and broadly rounded, the frontal angle about 90° and rounded, and the upper angle about 70° and more or less rounded; when seen

from front deeper than the width, both the frontal and facial margins straight, and the former much shorter than the latter and about as long as the outer-lower margin which is very slightly curved below, the outer-upper margin longest and more than twice of the frontal margin and evenly rounded, the frontal angle about 145°, and the lower angle about 95° with rounded angle; facets on wholly the upper two-thirds very much larger (about seven times) than those on the lower part, and the large facets extend upwards to the vertex and downwards to and rather beyond the junction of the eyes, while the small facets extend in a narrow zone up along the back margin; the dividing line across the eyes is rather undulating about the middle of the dark portion of the frontal triangle, and it runs somewhat horizontally for a short distance behind and then going slightly below obliquely and after the middle of the eye gradually upwards, and the line at least advances up to the vertex, the back zone keeping nearly equal in width throughout but very slightly contracting towards the vertex; in death reddish brown with the small facets black with a coppery shimmer, but about the middle of the large facets more or less blackish as if it has a broad transverse band, or sometimes very conspicuously triangularily blackish.

Thorax darker or seldom greyer than the female, with less conspicuous stripes; the erect black pubescence on the disc longer and much numerous and with less short yellowish hairs intermixed; the tufts on the bases of the wings and on the postalar calli nearly as same as those in the female; scutellum somewhat larger than that in the female, and similarily pubescent; pubescence on the pleurae much denser and longer, and on the mesopleurae there are much more conspicuous blackish hairs intermixed.

Wings, squamae, and halteres almost as in the female, the first shorter than the thorax and abdomen together and with rather narrowed apex and longer discal cell.

Legs almost as in the female, but with the less conspicuous

yellowish grey or pale reddish yellow portion of the tibiae especially on the front pairs hardly whitish about the basal third; pubescence denser and longer, with much more black one intermixed.

Abdomen less flatter than in the female, conical, about as long as or apparently shorter or very seldom slightly longer than the head and thorax (including the scutellum) together, coloured and marked as in the female but sometimes more brownish about the sides of the basal segments, and lateral grey spots on the second segment being much larger and conspicuous; the underside less greyish with rather much darker median part.

Length: 17-20 mm.

This species varies a little in both sexes, in the colouring of the antennae and in the amount of the black pubescence on the legs, as well as in the male, in the colouring of the front tibiae. It is easily distinguished from *Tabanus amaenus*, Walker, by the well-defined and large ashy grey median triangles and only two or three pairs of the greyish lateral triangles on the abdomen, and by its rather smaller size, as well as in the male the absence of reddish colouring of the sides of the basal abdominal segments. We have no other allied species in Japan.

T. mandarinus is not an uncommon Japanes species, as I have records from Hokkaido, Honshu (from the northern to the sonthern extremities), Shikoku, Kiushu, snd Formosa (throughout the Island); and my dates are mainly from July 4th to August 21st in Japan and Formosa, but I believe I have a record as early as April 12th in Formosa, and record as late as September 28th in Japan. It is recorded from practically all the coast of China, including Hongkong.

The female flies bite horses or cattle, free in somewhat high meadow pastures, or in sometimes rather plain pastures, and it is probably an extensive transmitter of a certain infectious anoemia of horses in Japan. It sometimes attacks men working in the fields, but it seems they feel only the slightest pain.

Tabanus yokoamensis, Bigot, might possibly be a denuded species of the *mandarinus*, as one denuded from Akita (August 15th, 1913) agreeing with Bigot's description is quite identical with the latter species, and I have found that two materials of *mandarinus* have a very mediocre development of the ocelligerous tubercle.

19. **Tabanus amaenus**, Walker. (Pl. VI, fig. 6).

(Taiwan-shirofu-Abu).

List Dipt. Brit. Mus., I. p. 163, 1848.
V. d. Wulp, Cat. Dipt. South Asia, p. 60, 1896.
Kertesz, Cat. Dipt., III, p. 220, 1908.
Ricardo, Rec. Ind. Mus., IV, p. 167, 1911; Ann. Hist.-Nat. Mus. Nat. Hung., XI, p. 169, 1913.

Tabanus clausacella, Macquart, Dipt. Exot., supple., V. p. 45, 1855.
V. d. Wulp, Cat. Dipt. South Asia, p. 60, 1896.
Ricardo, Rec. Ind. Mus., IV, p. 167, 1911.
Kertesz, Cat. Dipt., III, p. 235, 1908.

Tabanus administrans, Schiner, Reise der Novara Dipt., p. 83, 1868.
V. d. Wulp, Cat. Dipt., p. 61, 1896.
Kertesz, Cat. Dipt., III, p. 218, 1908.
Ricardo, Rec. Ind. Mus., IV, p. 167, 1911.

Tabanus signatipennis, Protschinsky, Horae Soc. Ent. Ross., XXI, p. 180, 1887.
Kertesz, Cat. Dipt., III, p. 279, 1908.
Ricardo, Rec. Ind. Mus., IV, p. 167, 1911.

Bellardia sinicus, Bigot, Mem. Soc. Zool. France, V, p. 629, 1892.
Ricardo, Rec. Ind. Mus., IV, p. 167, 1911.

Tabanus sinicus, V. d. Wulp, Cat. Dipt. South Asia, p. 62, 1896.
Kertesz, Cat. Dipt., III, p. 279, 1908.

Tabanus okadae, Shiraki, Noji-Shikenjo Tokubestu-Hokoku, Agr. Exp. St. Governm. Formosa, VIII, p. 285, 1913.

A medium-sized greyish black species with an oblong black frontal callus which has a linear extension, five faint grey stripes on the thorax, three series of yellowish grey spots on the abdomen, and the first posterior cell of the wings closed with a rather long petiole.

Female. Head a little broader than the thorax, short, and moderately arched. Frontal stripe pale yellowish brown or yellowish grey, paler on the upper part but rather distinctly darker at the vertex, contracting from the vertex to the front eye-angles but in a species from Taihoku took by Mr. T. Sugimoto parallel-sided and rather broad, and about four and a half or five times as long as its broadest part or wholly seven times as long as its narrowest part; pubescence on the frontal stripe mainly black with a very few scattered inconspicuous yellowish hairs intermixed on the lower part, the black pubescence being suberect on the mostly part but irregularily curved on about the middle part where is seems as if it bears rather dense black pubescence, on the vertex more numerous and rather depressed but at its sides rather erect; frontal callus long and slender, not reaching the eye-margine and separated from the frontal triangle by a narrow straight transverse greyish stripe, gradually but slightly narrowed at the top where it has a long (about one and a half times as long as the callus proper) linear extension, blackish and shining but usually reddish about the lower extremity, very slightly convex throughout the whole length, with an irregular inconspicuous longitudinal fine sulcus which does not extend up to the linear extension. Frontal triangle broader than the length, covered with pale yellowish ashy-grey tomentum, flat but very slightly raised just above the antennal fossae, with a distinct but very fine longitudinal sulcus which is not sometimes extending up to the upper margin where there is an inconspicuous transverse furrow, the lateral ends of this furrow sometimes being brownish, the surface being irregularily sculptured by the oblique or transverse depressions. Face ashy grey with very slight pale yellowish tinge on the upper part, covered with very short and fine whitish

(with a slight silvery shimmer) pubescence which becomes conspicuously numerous and longer about the jowls and extends up a little to the back of the head; back of the head moderately hollowed out, ashy grey tomentose and covered with some scattered white pubescence which is apparently longer than that on the epistoma, with an equal narrow ashy grey postocular rim behind which is a short but rather conspicuous dark brown ciliation and behind that with a more conspicuous and longer pale yellowish fringe which becomes much longer and more outstanding on the upper part, though the interval between the eyes at the back of the vertex bears only a few longer pale hairs. Proboscis short and stout, less than two-thirds of the depth of the head, blackish brown, covered with short and erect whitish pubescence behind the stalk; the sucker-flaps large and about three-fourth as long as the proboscis, furnished with very short scattered brownish hairs beneath and with some longer blackish brown hairs intermixed. Palpi long and slender, hardly reaching the end of the proboscis, pale yellowish; basal joint oblong and about one-fourth as long as the end joint, slightly covered with greyish or sometimes dark greyish tomentum, and clothed with long (but shorter than that on the jowls) pale yellowish grey pubescence; second joint very long and slender, but stout about the basal third and than drooping and gradually tapering to a rather sharp point, about three and a half times as long as its thickest part, obscured by numerous dense short depressed black pubescence on the outside excepting of the base where there are some short inconspicuous whitish hairs especially on the underside. Antennae usually reddish yellow but sometimes reddish black or reddish brown; basal joint cylindrical though short, inconspicuously thickened at the apex where it has a broad rather short expansion, slightly covered with a greyish tomentum, the upper side bearing tiny black pubescence which more or less extends below the innerside near the top, and fine but longer whitish hairs on the lower half; second joint small, and about one-thirds as long as the basal joint, usuall

much redder than the first joint, with a conspicuous process at the dorsal apex and with a complete circlet of tiny black bristles which becomes slightly longer on the underside; third joint about twice as long as two basal joints together, darker with the basal annulation reddish yellow to reddish black, about three times as long as its broadest part, and large dorsal hump near the base crowned with some tiny black bristles; basal annulation of the third joint very slightly shorter than the style-like portion and about one and a four-fifth times as long as its broadest part, usually darker apically; the style-like portion gradually narrowed to a sharp point, with the apical annulation about twice as long as the shortest second annulation, bearing one or two inconspicuous pubescence on each annulation but on the apical one somewhat conspicuous. Eyes bare, when seen from above the frontal margin about four-fifth as long as the hind margin which is nearly straight and forms a upper angle about 100° with the frontal margin, and the outer margin moderately rounded; in profile oval, deeper than the length, with the frontal, lower, and hind angles rounded and with the upper angle smaller though rounded; when seen from the front about as wide as the depth, the frontal angle about 145°, the lower angle about 110° and rounded, the upper angle about 50° and the outer angle evenly rounded, and the facial margin about as long as the frontal margin; in death deep purplish black with a greenish shimmer in a certain light, without any spots or bands.

Thorax about as long as wide, moderately rounded. Dorsum greyish brown or greyish black, with five faint stripes of which the middle one is narrowest and more greyish but extends only a little after the suture, and the next two are slightly wider, reaching the posterior margin, and somewhat broadened and obscured at the suture after which they become very inconspicuously oblique inwardly, while a lateral pair is very faint, broadest, and extends from the humeri to the postalar calli passing on the praealar calli, and after the suture they rapidly become narrow and innerside of this part there is an

other somewhat conspicuous greyish brown stripe from the upper angle of the praealar callus to the postero-inner end of the postalar callus, which is separated from the lateral stripe by a narrow not well-defined brownish linear interval; pubescence on the disc rather dense and short, depressed, golden yellow, which is intermixed with numerous suberect and longer conspicuous black hairs, the both yellow and black hairs not extend on the anterior vertical part where there are only numerous pale yellowish grey hairs which extend behind the space between the humeri and praealar calli, and the upper bases of the wings with conspicuous whitish tufts which are similar to those on the postalar calli but apparently smaller and shorter; humeri covered with ashy grey or pale reddish grey tomentum and with numerous but not very dense long whitish grey pubescence; praealar calli triangular with slightly rounded margins, pale brownish grey or pale greyish black, covered with numerous moderately long stout and erect though irregularily curved black pubescence which is intermixed with shorter yellow hairs on the upper half; postalar calli bearing some rather depressed golden yellow pubescence with numerous long and suberect black hairs intermixed, and on the outer margin there is a long conspicuous whitish tuft; scutellum rather large and somewhat triangular, bearing dense short golden pubescence with numerous longer and stouter conspicuous sloping black hairs intermixed all over the surface, while the posterior margin bears a rather inconspicuous yellowish grey fring. Pleurae covered with whitish grey tomentum and with numerous soft pale yellowish grey pubescence which becomes longer and denser on the upper part and is intermixed with black hairs on about the upper part of the mesopleurae, and on the upper margins of the meso-, ptero-, and meta-pleurae, there are long and somewhat shaggy conspicuous whitish tufts of which the anterior one is nearly pure white in a certain light, and the prothorax is rather large and covered with rather dense and long whitish grey pubescence.

Wings slightly shorter than the thorax and abdomen together,

hyaline but somewhat infuscate and very often tinged with yellowish along the veins, with the veins dark brown but usually yellowish brown on the basal parts of the radial, cubital, and postical veins, and with the stigma yellowish brown; both the first posterior and anal cells closed with a rather long petiole, but in some specimens from Taihoku the former widely open, and discal cell moderate in size and slightly longer than the second posterior cell; the upper branch of the cubital fork without the recurrent veinlet but very rarely with its indication. Squamae in the alar pair glassy grey with a brownish black margin and a dense conspicuous dark brown ciliation excepting for a long (but not very long) deep orange yellow tuft about the angle, in the thoracal pair yellowish brown with a dark brown margin and a brown ciliation of fine pubescence which is slightly longer and sparser than that in the alar pair. Halteres yellowish brown but the knob dark brown with the apex yellow.

Legs blackish, with the extreme apices of the femora, and with the basal two-third of the front tibiae and the posterior two pairs of the tibiae except at their apices, yellowish; front coxae dilated and about two-thirds as long as the front femora, densely covered with an ashy grey tomentum and with long whitish grey pubescence which becomes conspicuously shorter towards the apex; front femora dusted with grey excepting of the broad shining black subfemoral bare space which is inconspicuously transversely striolate and grooved about the apical half, and at the inner margin of this bare space is short and stout very conspicuous black ciliation; pubescence on the front femora mostly very short and black on the inner surface, and long and pale yellowish grey (with a silvery shimmer in a certain light) on the outer surface where there is a very few stout black hairs about the apices and sometimes is one or two conspicuous black bristly hairs about the middle, on the posterior two pairs covered with pale yellowish ashy grey tomentum almost all over the surface and clothed with numerous whitish (with a silvery shimmer in a certain light) pubescence which

becomes longer on the underside especially about the base, and on the upper apices there are some long conspicuous black bristly hairs which are directed apically; front tibiae not dilated but curved as usually, the blackish part slightly extending up to about the middle only along the underside, and covered with tiny depressed black pubescence which is sometimes very sparsely extending up to the base along the upper side; pubescence on the rest mostly very short depressed whitish, with a silvery shimmer in a certain light, but on the brownish underside suberect and reddish yellow; pubescence on the middle tibiae short, and mostly whitish with a silvery shimmer in a certain light, but on the blackish apical part entirely black, the black pubescence extending up to the base along the rather broad upper surface, with rather short unequal blackish brown apical spurs; pubescence on the hind tibiae whitish, with a silvery shimmer in a certain light, but the innerside almost always with black pubescence which is intermixed with some pale hairs about the basal half, and on the upperside there are two somewhat long black fringes of which the outer one is longer and more conspicuous and sometimes is intermixed with white hairs on the basal third or half, pubescence on the blackish part black; tarsi on the posterior two pairs usually slightly brownish and with reddish orange soles; pulvilli dull yellowish, and claws deep black.

Abdomen broader than the thorax and longer than the head and thorax (including the scutellum) together, gradually narrowed from about the base to a blunt roundish apex, moderately convex above and below. Dorsum blackish brown with the basal extremity greyish, with three rows of the yellowish grey triangle spots of which the median ones are continuous with one another but not occur on the seventh segment, while the outer two are usually less conspicuous, though two pairs on the second and third segments large and more distinct, and are oblique but gradually becomes less oblique and more faint towards the apical segment on which they are hardly visible; the posterior extremities of the segments very narrowly and inconspicuously pale

except on the seventh, and the sides pale yellowish or pale reddish yellow; pubescence on the disc short and depressed, black and yellow but on the greyish spots and the posterior margin mostly yellow and on the sides entirely whitish. Ventre covered with ashy grey tomentum, with the rather conspicuous yellowish posterior margins except on the seventh which bears numerous long curved black bristly hairs, pubescence mostly whitish but on about the middle third through the second to sixth segments black and a little longer.

Length: 14–18 mm.

Male. Similar to the female but more brownish with the abdomen reddish brown on the basal segments. Head broader than the thorax and abdomen, large. Frontal triangle not inflated but flat, covered with pale yellowish grey tomentum, with the upper angle conspicuously brown-tinged and prolonged narrowly a very short distance between the eyes, as in the preceding species, and with a fine median sulcus which does not usually extend up to the upper top, and the sides of the sulcus somewhat depressed about the middle; face and jowls very pale yellowish grey, clothed with dense but rather short pale yellowish grey soft pubescence which is conspicuously longer on the jowls, while it is bare on the epistoma which is quite sunken and elongate-triangular, and cheeks consequently broad and inflated but not strongly raised up from the eye-margins; back of the head rather shallow on the lower part where there are some short pale hairs which come from on the jowls, but hollowed out behind the eyes on the upper part, and with a minute blackish brown postocular ciliation which becomes paler near the jowls and behind which there are some scattered long whitish hairs all over the grey surface; vertex oblong and tubercular, brown, very slightly raised up from the eye-level or is in the level, and bearing a few somewhat conspicuous dark brown pubescence behind. Proboscis about half as long as the depth of the head, narrower than that in the female, blackish brown, behind the stalk bearing some comparatively long brown pubescence which becomes

whitish on about the median longitudinal line especially about the base; sucker-flaps large and wholly two-thirds as long as the whole length of the proboscis, darker, and bearing very few shorter and very sparse brownish bristly though rather fine hairs beneath. Palpi short and somewhat cylindrical with the apex thickened, pale yellow or dull yellow; basal joint greyish with some darker tinge on the outside, rather long and cylindrical, about two-thirds as long as the end joint, covered with numerous long pale yellowish grey or whitish pubescence; second joint thickened about the apical half and about twice as long as its thickest part, with a rather rounded blunt top and covered with shorter whitish pubescence which becomes much shorter and yellowish about the tip on where there are some rather conspicuous short black bristly hairs which sometimes extend behind to the middle along the outer-lower side. Antennae almost as in the female but more yellowish with the style-like portion distinctly blackish, which is more slender and longer and its apical annulation being wholly twice or about three times as long as the preceding annulation, each of the three basal annulations of the style usually longer than the width. Eyes large, conspicuously broader than the thorax but shorter, bare from pubescence; when seen from above triangular with the hind margin slightly concave and with the outer margin usually convex, and the frontal margin slightly longer than or almost as long as the hind margin; in profile conspicuously deeper than the length, irregular triangular with the longest posterior margin strongly curved outwards, the frontal margin next in length and very slightly convex, forming about 95° but rounded angle with the shortest facial margin which is very slightly curved at both the ends, and the lower angle about 90° and largely rounded; when seen from front about two-thirds as wide as the depth, with the frontal margin a little shorter than or about as long as the facial margin which is nearly straight and forming a lower angle about 100° but rounded, the frontal angle about 150° and the outer margin very strongly convex especially at the lower half; facets on about the upper

three-fourth very much larger (about eight times) than those on the lower part, and the large facets extend upwards to the vertex and downwards beyond the junction of the eyes, while the small facets extend in a narrow zone all up along the back margin, the line of the separation conspicuous and undulating and more obliquely downwards than in *Tabanus mandarinus*, but the vertical portion in the narrow zone very inconspicuous; in death pale reddish brown or greenish yellow with darker median area which is usually transverse triangular, and with a shimmer in a certain light.

Thorax rather broader than in the female and the darker grey stripes less evident and appearing in perfect specimens as faint narrow stripes of brown or brownish yellow tomentum but the middle one more conspicuously divided into two laterals by a fine but very conspicuous dark brown line nearly throughout the length; the depressed yellow pubescence less generally diffused and less obvious, and the erect black hairs on the disc longer and more evident, which causes the stripes to become less conspicuous; the lateral stripes much more inconspicuous and the dividing stripe on the lower half hardly visible, and the tufts on the upper wing-bases and on the posterior margin of the postocular calli less conspicuous owing to the colour dull yellowish grey; pubescence on the pleurae longer and shaggier and more abundant, and with more black hairs intermixed on the meso-pleurae; scutellum browner and with the black pubescence longer and more abundant, but the yellow depressed one less and more inconspicuous.

Wings, squamae, and halteres as in the female.

Legs as in the female, but the pale pubescence usually light yellowish without a shimmer and the black one almost always more abundant and more obvious, and the colour being more dull especially on the front tibiae which has no distinct whitish basal portion.

Abdomen more conical, as long as the head and thorax (including the scutellum) together; dorsum more brownish, with the lateral third or more usually reddish brown excepting the apical segments,

and the four distinct lateral triangles therefore reddish yellow; the pubescence on the dorsum similar to that in the female but a little longer; ventre usually pale yellowish red or yellowish brown on the four basal segments, similarily dusted and haired as in the female.

Length: 15-18 mm.

Var. *lateralis*, n. (Pl. VI, figs. 7 & 8; Pl. X, figs. 16 & 17).

Head, thorax, legs and wings the same as in the typical *T. amaenus*, but the dorsal abdomen of the female with reddish yellow lateral stripes composed of oblique irregular spots on each segment from the first to the third or fourth, these spots situating on the side (where the typical side-flecks should be) and more or less obscuring by a yellowish grey tomentum and pubescence, and the ventral side with a large obscured yellowish red spot between the first and second segments, with a narrow transverse similar marking on the base of the third segment, and with the irregularily situated slightly broader pale segmentations; the male usually with the more extended reddish yellow lateral markings.

I have good many specimens of this form, which were taken by many collectors at several districts in Kiushu, from June to July.

This species varies but little in the Formosan materials I have seen, but apparently Japanese ones vary in the amount of reddish brown colouring on the abdomen of the male (and the female of the variety), and to a small extent in the practical absence of any reddish colouring of the antennae in the female. It is allied to *Tabanus mandarinus* and *T. takasagoensis* (n. sp.), but is easily distinguished from the latter by its much narrower frontal stripe, by its darker legs with the tibiae conspicuously whitish, by its golden yellow pubescence on the disc of the thorax, and by its larger size; and from the former by its first posterior cell of the wings constantly closed with a long petiole, by the three rows of triangles on the abdomen in the both sexes, and by the reddish abdomen in the male.

A series of this species from Tamsui (Formosa), collected by Mr. K. Okada, in 1911, have been described by the author as *T. okadae*, in the Tokubetsu-Hokoku, Agr. Exp. Stat., Taihoku, Formosa, VIII, p. 285, 1913, but on later study, he found that all the materials were very nicely denuded and that it no doubt belongs to the smallest form of *T. amaenus*.

T. amaenus is not uncommon throughout Formosa, except at the southern extremity, and also I have records from many parts of Japan from July 5th to September 3rd. In Hokkaido I took this species at Sapporo and Ono, both in August, and in other countries it has been recorded from Chinese Mongolia, Shanghai, Foo Chow, Swatow, and Hongkong.

The females are rather familiar to our cattle especially in Formosa, where even baffaloes are very often attacked by a small swarm of them, at that time we can easily collect this species as it probably does not like to draw out its piercing stylet from the skin of the host during the feeding. In Japan it is also noticed that the female bites horses or cattle, but it may be less abundant that *T. mandarinus*. I have no record, that this fly bites men, from either Japan or Formosa, but it may do so.

The male insect has been frequently taken by collectors in uncultivated fields in the afternoon or sometimes morning, while the female fly is usually found on the pastures near villages or towns generally in the day time from April to September in Formosa, but from July to the beginning of September in Japan.

20. **Tabanus takasagoensis,** Shir. (n. sp.) (Pl. VII, fig. 2; Pl. XI, figs. 7 & 8).

(Gi-Shirofu-Abu).

A brownish medium-sized (but rather small) species with the broad frontal stripe, on which a frontal callus is rather stout and yel-

lowish brown, and with three rather large whitish grey triangles on the abdominal segments, as well as with five rather broad grey stripes on the thorax.

Female. Head broader than the thorax, and less than half the length of the thorax, moderately arched. Frontal stripe broad, contracting from the vertex to the eye-angles, and about four and a seven-tenth times as long as its narrowest part or about three and a two-fifth times as long as its broadest part, covered with pale yellowish tomentum which becomes more whitish above, and clothed with numerous short sloping blackish brown pubescence which becomes irregularily suberect about the middle, and at the sides there are some pale yellowish white hairs which grow up numerous and more conspicuous down to the callus proper; the surface of the frontal stripe very inconspicuously elevated from the eye-level, with two rather distinct but fine oblique depressed stripes, of which each extends from just below the vertex to below the middle of the eye-margin but not united with one another at the upper end, the space between these two stripes being dark brown when seen from in the front owing to the numerous irregularily directed blackish brown pubescence; vertex rather well-defined, covered with somewhat longer blackish brown pubescence and without any trace of the ocelligerous tubercle; frontal callus rather large and moderately convex, reddish brown but darker brown at the upper extension which is rather broad but still linear and pointed and is a little longer than the lower broad part where it is oblong gradually narrowed above, and about twice as long as its widest part, this callus distinctly separated from the eye-margins by the narrow yellowish grey dusted intervals but touching the frontal triangle; frontal triangle clothed with pale yellowish grey tomentum which becomes more yellowish on the double crescent just above the antennal fossae, slightly elevated, apparently broader than the length, with a fine but conspicuous median sulcus and with two broader but not well-defined oblique furrows situated near the eye-margin and parallel with the

latter. Face dusted with ashy grey but slightly yellowish above, moderately convex, about half as long as its width with the large subquadrate epistoma which bears short and thin white pubescence which grows up slightly longer more numerous and brownish about the outer upper corners; cheeks moderately inflated, covered with rather numerous longer white (with a silvery shimmer) pubescence which becomes conspicuously shorter near the eye-margin throughout but very conspicuously longer and more numerous about the jowls and extends up a little to the back of the head; back of the head very shallow on the lower part but moderately hollowed out on the upper part behind the eyes, and covered with rather conspicuous but fine scattered whitish pubescence all over the surface; postocular margin with a comparatively broad pale yellowish bare rim which gradually becomes narrower towards the jowls, behind which is a short ciliation of pale yellowish bristly hairs which gradually grow a little longer right up to the upper eye-angle but shorter near the jowls. Proboscis moderately long and slender, wholly two-third as long as the depth of the head, dark brown, furnished with abundant erect brownish pubescence behind the stalk; the sucker-flaps large and longer than the half of the proboscis, bearing rather abundant long or short brown bristly hairs beneath. Palpi slender and long but about two-thirds as long as the proboscis, pale yellow; basal joint rather long; slightly thickened apically and slightly darkened about the base, covered with long numerous pale yellowish white pubescence; second joint slender and about two and a half times, but moderately stout about the basal thirds and then drooping and gradually diminished to a rather short point, covered with numerous tiny depressed black bristles at the upper and outer sides except at the base where is a few whitish soft pubescence especially beneath. Antennae yellowish brown with apical joint dark brown; basal joint slightly dusted with grey or dark grey, thickened towards the top which on the dorsal side is moderately produced forwards, covered with dense tiny black pubescence on the upper

half (except about the base) but the lower half nearly bare and on the basal half of the outside there are rather conspicuous fine pale hairs intermixed; second joint very small and about one-thirds as long as the first joint, with a rather long and thin spine-like dorsal process on the apical margin near which is a complete circlet of tiny black bristles; third joint with extreme base more or less yellowish brown, wholly twice as long as the basal two joints together or about three times as long as its broadest part; the broad basal annulation of this joint as long as the style-like portion and about one and a half times as long as its broadest part, near the base with the large triangular dorsal hump crowned with a very few inconspicuous black bristles; the style-like portion rather stout and short, with the apical annulation short and conical, each of the annulation bearing one or two very minute inconspicuous pubescence near the tip. Eyes bare, in profile apparently deeper than long, nearly regular oval, and in death deep purplish black with a coppery shimmer in a certain light but there is no markings or bands; when seen from the front deeper than wide, the frontal margin about as long as the facial margin which is very slightly convex and is forming a rounded lower angle about 110° with the outer margin, the frontal angle about 140°, and the the upper angle about 90°, while the outer angle very largely and evenly rounded.

Thorax somewhat roundish, brown. Dorsum covered with a greyish tomentum, and with five broad conspicuous grey stripes of which the middle one is narrowest and extends below to the suture, and the next two are more conspicuous and extend below to the posterior margin, but after the suture gradually approaching from one another leaving only a narrow rather distinct brownish linear interval which becomes slightly broader at the hind margin, and on the suture they are broadened outwardly and therefore connected with the lateral stripes there, while the lateral stripes are broadest and extend from the humeri to the postalar calli passing on the praealar calli and they have a rather faint pale brownish linear spot on the part between the

praealar and postalar calli; pubescence on the disc fine, recumbent, whitish grey, intermixed with numerous conspicuous suberect moderately long black hairs which become thin but slightly longer on the apical vertical part, the pale hairs extending behind on the part between the humeri and praealar calli; humeri yellowish brown, obscured by a grey tomentum, and covered with pale long hairs; praealar calli large and conspicuous pale reddish brown, covered with grey dust and fine rather inconspicuous white pubescence which is intermixed with stout conspicuous black hairs all over the surface and on the lower margin there are numerous black bristly hairs which are very slightly extending before the surface between the humeri and praealar calli; postalar calli somewhat pale reddish brown about the posterior margin but obscured by a grey tomentum, bearing abundant rather inconspicuous whitish pubescence intermixed with more conspicuous stout black hairs, and on the posterior margin there is a moderately long somewhat conspicuous whitish tuft, the similar but less conspicuous one on the upper base of the wing; scutellum obscured by a pale yellowish grey tomentum, and covered with numerous whitish and black hairs similar (but slightly longer) to those on the disc, and on the posterior margin there is a rather conspicuous but not very long whitish fringe. Pluerae covered with dense pale yellowish grey tomentum and with long somewhat abundant whitish grey (with a silvery shimmer in a light) pubescence which becomes longer and denser on the upper part, and is intermixed with some longer black hairs on the upper part of the mesopleurae; pubescence on the prothorax very long and numerous, whitish with a silvery shimmer in a certain light; on the postero-upper margins of the meso- and meta-pleurae there is the tuft of very long shaggy whitish grey hairs, while on the ptero-pleurae there is similar but slightly shorter pubescence all over.

Wings about as long as the thorax and abdomen together, hyaline but slightly tinged with pale brown, with the veins brown but the mediastinal, radial, and postical veins paler, and with the stigma

yellowish brown first posterior cell closed very near or at the wing-margin or sometimes very narrowly open, while the anal cell closed with a long petiole ; discal cell moderate in size and nearly as long as the second posterior cell, the upper branch of the cubital fork without the recurrent veinlet ; squamae in the alar pair glassy grey with a blackish brown margin and a rather conspicuous brown fringe excepting for a long whitish tuft about the angle ; in the thoracal pair pale brown with a brownish margin and a rather inconspicuous pale fringe ; halteres brown with the top pale yellowish grey.

Legs brownish, with the extreme apices of the femora, the basal three-fifth of the front tibiae, and two pairs of the posterior tibiae (excepting of the tops) pale yellowish but obscured by a grey tomentum ; front coxae moderately dilated and about two-third as long as the front femora, covered with dense whitish (with a silvery shimmer in a certain light) tomentum and numerous long conspicuous whitish pubescence which becomes shorter and less erect towards the top ; front femora covered with pale yellowish grey tomentum leaving a broad shining castaneous brown subfemoral bare space which is not hollowed out but rather distinctly transversely striolate, and clothed with numerous short whitish pubescence which becomes shorter and depressed on the innerside where there are some inconspicuous similar but brown hairs intermixed, the ciliation on the inner margin of the subfemoral bare space consisting of short and stout blackish bristles ; two pairs of the posterior femora pale castaneous brown, obscured by a pale yellowish grey tomentum, and covered with whitish pubescence which grows up conspicuously longer about the upper base of the hind pair, and becomes moderately longer on the outer side of the middle pair and on the underside of the hind one, and on the middle femora there is some scattered short black bristly hairs intermixed on the upper side especially on about the middle ; near the tops of the femora bearing a very few stout and curved black bristly hairs above ; front tibiae not dilated but curved as usual, the under side of the pale

portion slightly tinged with yellowish brown, the pubescence very short and depressed, white intermixed with some scattered black hairs on the dorsal side, but on the black portion mainly black, while the pubescence on the underside is very tiny dense suberect and yellowish; pubescence on the middle tibiae short and stout black on the upper side and about the apical thirds, but fine and whitish on the rest; the apical spurs of the middle tibiae rather long, unequal, brownish with the tip black; pubescence on the hind tibiae similar to that on the middle one but slightly longer, and there is a rather conspicuous longer outer-upper fringe composed of black and white hairs; tarsi blackish brown but the front pair nearly black, while the posterior two pairs bear reddish brown sole. Pulvilli pale yellowish brown, claws black with the base yellowish brown.

Abdomen broader than the thorax about the base and gradually narrowed to a large blunt rounded apex, and longer than the head and thorax (including the scutellum) together. Dorsum brownish slightly obscured by a greyish tomentum, with three rows of rather large ashy grey tomentose triangles which have a silvery shimmer in a certain light, all of three rows continuous and extending from the basal segment to the sixth segment but the middle one not commencing from the basal segment; the lateral triangles oblong and oblique, and larger than the middle one, but sometimes smaller on the posterior three segments (not including the seventh); the very extreme hind margins and the sidemargins of the segments pale orange yellow, and the sides of the basal two segments more or less pale; pubescence on the disc mainly short and black, but whitish on the triangles and on the margins (excepting of the seventh segment). Ventre paler than the dorsum especially on the basal segment, covered with rather dense ashy grey tomentum which becomes gradually less dense towards the anal apex, and with very fine greyish pubescence all over the surface but on the seventh segment there are abundant long curved black bristly hairs and on the two preceding segments with a few long

sloping blackish hairs intermixed about the middle, while the second segment near the front margin bears long and erect but fine rather inconspicuous greyer hairs which do not extend below to the following segments.

Length: 14.3-15 mm.

This species is easily distinguished from *T. amaenus* by its colour of the thorax and abdomen, by its broad frontal stripe containing a rather broader and shorter callus, by its browder and more conspicuous grey stripe on the thorax, by its ashy grey triangles on the abdomen, by the closed or open (but very narrowly) first posterior cell of the wing, and by its whitish pubescence on the thorax.

T. takasagoensis may be uncommon in Japan, as I have records only from Takasago (July 31st), Kumamoto (July 3rd), Kagoshima (July 29th) and Iyo (July 21st); and the male is not known to me yet. I collected a single female, which was biting a horse on the country road from a village to the town of Hitoyoshi in July. There is no other records of the habits of this fly.

21. Tabanus crassus, Walker. (Pl. VII, fig. 5).

(Koshi-shiro-Abu).

Dipt. Saund., I, p. 50, 1850.

V. D. Wulp, Cat. Dipt. South Asia, p. 60, 1896.

Kertesz, Cat, Dipt., III, p. 237, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 189, 1911; Ann. Hist.-Nat. Mus. Nat. Hung., XI, p. 170, 1913.

A dark brown medium-sized species with two basal dorsal segments of the abdomen whitish.

Male. Head rather small, about as wide as the thorax. Frontal triangle flat, slightly prolonged up between the eyes, covered with

pale brown tomentum except at the upper corner where it is dull brown, and in the middle there is a fine though conspicuous sulcus not extending on the undusted portion, and near the sides two very inconspicuous oblique depressions. Face covered with pale brown tomentum and with numerous long and erect dense blackish brown pubescence which does not extend on the deeply sunken epistoma but there are a few short inconspicuous paler hairs near the mouth-edge; cheeks inflated but not conspicuously raised up from the eye-margins, their pubescence growing up longer and more denser on the jowls and extending up to the back of the head which is covered with yellowish grey tomentum and blackish brown hairs, and which is conspicuously hollowed out nearly whole of the brown surface so as the postocular rim is not seen from above; vertex very small and tubercular, pale brown, almost bare but bearing a few short dark brown pubescence behind. Proboscis very short and stout, blackish brown, bearing numerous long blackish brown pubescence behind the stalk; sucker-flaps comparatively very large, wholly two-thirds as long as the proboscis, furnished with fine and scattered brownish bristly hairs beneath. Palpi very short and stout dark brown but slightly obscured by a yellowish grey tomentum; basal joint narrow and cylindrical but thickened towards the top, about two-thirds as long as the apical joint, covered with numerous comparatively shorter blackish brown pubescence which is about thirds as long as that on the jowls; second joint stouter than the first joint, oval gradually thickened towards the top but rapidly narrowed about apical fourth and the extreme tip with a small pointed process which is directed slightly below, the outerside covered with numerous long blackish brown hairs similar to those on the basal joint but slightly shorter beneath the pointed tip. Antennae very slender, yellowish brown or dull reddish yellow with the style-like portion slightly darker; basal joint broadest with the dorsal apex conspicuously produced over the second joint, covered with very short depressed black pubescence on the upper and outer side, and with a very few

inconspicuous yellowish hairs intermixed about the outer apical half, and on the lower side there are some conspicuous long black hairs; second joint very small, about third as long as the first joint, with a moderately long and narrow apical process, and with an incomplete circlet long black bristly hairs near the top; third joint very slender and about three times as long as two basal joints together, the basal annulation more than twice as long as its broadest part where it is narrower than the apex of the basal joint and near the base with the rather flat dorsal hump crowned with a few tiny conspicuous black bristles, while the style-like portion is very long and longer than the broad basal annulation and the apical pointed annulation is wholly two-thirds as long as the preceding three annulations together, these three basal annulations of the style-like portion being elongate quadrate and gradually lengthened towards the apical one and bearing one or two tiny inconspicuous pubescence near the tips. Eyes large, touching for about five-seventh the whole length of the frontal margin, in death brownish black but deep purplish black on the lower thirds, with a metallic shimmer in a certain light; when seen from above the frontal margin about two-thirds as long as the hind margin which is slightly concave and is forming upper angle about 95° with the frontal margin, and the outer margin conspicuously convex and the frontal angle about 70°; in profile irregular triangular with all the margins slightly convex, and about twice as deep as its length, the hindmargin longest and the facial margin shortest, the frontal angle about 100° but bluntly rounded, the upper angle smallest and about 70°, and the lower angle next in size and somewhat evently rounded; when seen from in the front deeper than the width, the facial margin nearly straight and a little longer than the frontal margin, the frontal angle about 140°, the lower angle slightly rounded and about 100°, the upper angle 90°, and the outer angle rounded and situated below the middle of the whole length of the outer margin; facets on nearly the upper two-thirds very much enlarged (about eight or four times as large as the

small ones), especially on the front part, and the large facets extend upwards to the vertex and downwards to and rather beyond the junction of the eyes, while the small facets do not extend in a zone up along the back margin though the contrast in size is not so conspicuous there; the dividing line across the eyes is hardly undulation but runs nearly straight across the eye to the zone of small facets.

Thorax rather large and slightly longer than wide, deep reddish brown or blackish brown, clothed with yellowish brown tomentum and long suberect dense blackish brown pubescence, somewhat shining, with five very inconspicuous brown or yellowish brown stripes which hardly extend behind the suture; the pubescence grows up very slightly longer towards the anterior border (though much sparser) and the sides, while the pubescence on the interval between the mesonotum and scutellum becomes much denser and more conspicuous; humeri conspicuously yellowish, covered with much longer brown pubescence; praealar calli somewhat conspicuous and more yellowish, with a rather dense blackish fringe of long somewhat bristly hairs about the lower margin; postalar calli more or less yellowish brown about the half, with a much longer dull brown tuft on the posterior margin, the same but shorter one on the upper base of the wing; scutellum triangular with the angle somewhat roundish, dull reddish brown or blackish brown, paler towards the posterior end, covered with longer and denser rather black pubescence all over the surface. Pleurae reddish brown or blackish brown, obscured by yellowish brown grey tomentum, and covered with denser and longer blackish pubescence which causes the darker colour, and which grows up much longer and much denser on the upper part; on the postero-upper margin of the mespleurae, and on the upper margins of the ptero- and meta-plurae, there are long conspicuous tufts of shaggy and dark brown hairs.

Wings slightly shorter than the thorax and the abdomen together, quite clear, with the veins yellowish brown but the costal and discal veins more or less blackish, stigma hardly apparent and pale yellow;

all the posterior cells widely open but the first one slightly narrowed at the margin, discal cell very broad, but not very longer than the second posterior cell, and the anal cell closed with a long petiole; the upper branch of the cubital fork without the recurrent veinlet. Squamae in the alar pair pale yellowish grey with a dark brown margin and a rather conspicuous brown fringe except for the long yellowish brown tuft about the angle; in the thoracal pair brownish grey with a brown margin and a little longer pale brown fringe; halteres dark reddish brown with the knob fresh pale yellow on the apical half.

Legs nearly uniformly pale castaneous brown, obscured by a thick close black pubescence; front coxae moderately dilated and about two-third as long as the front femora, obscured by a yellowish brown tomentum, and clothed with numerous long rather soft blackish pubescence which becomes shorter towards the apex; front femora with the broad and hollowed out transversely striolate subfemoral bare space shining, with a long and dense very conspicuous black fringe on the outside, and with a short inconspicuous black pubescence which extends below to the inner margin of the subfemoral space at where there is a short black ciliation of not dense bristly hairs; the middle femora bearing the long and rather conspicuous black fringes on both the outer and inner sides of which the outer one is slightly longer and more conspicuous, and covered with shorter black pubescence on the rest except on about the apical half of the underside nearly bare and shining; the hind femora covered with the black pubescence all over the surface, and bearing a very conspicuous black lower fringe of long rather soft hairs and less conspicuous similar coloured upper fringe which becomes conspicuously shorter towards the apex; front tibiae not dilated but slightly curved as usual, covered with numerous short depressed blackish pubescence; the posterior tibiae covered with a little longer but less denser black pubescence, the middle pair bearing a very sparse inconspicuous outer-upper fringe of very few long black hairs, while the hind tibiae bear a long dense very

conspicuous outer-upper black fringe and a short inconspicuous inner-lower one; tarsi all darker than the tibiae of which the front pair is much blackish and is rather flattened from above to beneath and it has yellowish sole, while the two posterior pairs have a reddish soles; the apical spurs of the middle tibiae moderate in length and blackish brown; pulvilli orange yellow, but paler on the front legs; claws black with the extreme base yellowish brown.

Abdomen about the base about as wide as the thorax and gradually narrowed to a narrow point, somewhat conical and slightly longer than the head and thorax (including the scutellum) together. Dorsum blackish brown or reddish brown, darker towards the anal extremity, with the segmentations very indistinctly paler; the two first segments conspicuously paler, and covered with dense snow whitish tomentum; the pubescence black, fine short and dense, but very sparse and inconspicuous on the white tomentose segments, which becomes longer and denser towards the apex and the sides at where there are somewhat conspicuous black fringes. Ventre paler than the dorsum, densely covered with shorter and finer depressed black pubescence which on the middle of the basal segment becomes erect and conspicuously longer, the seventh segment covered with numerous longer erect slightly curved black bristly hairs. Genitalia with two dark brown lamellae covered with short black pubescence.

Length: 18—20mm.

This species is easily distinguished from all the other species by the first two segments of the abdomen being whitish, and by the quite clear wings. *T. crassus* is quite a rare species in Formosa and probably in other countries, and in Formosa its occurence may be restricted only to the southern parts. The female is still unknown among entomologists. I have only two males from Takao (July 27th).

22. **Tabanus fuscicornis,** Ricardo.

(Kuro-bane-Abu.)

Rec. Ind Mus., IV, p. 144, 1911.

A very handsome black medium-sized species with the bright orange-red pubescence on the face and upper parts of the pleurae, with the white-haired median and lateral spots on the abdominal segments, with the black antennae and legs, with the dark rich brown wings, and with the narrow nearly parallel-sided frontal stripe which contains a broad and long black callus.

This species is nearly allied to *T. pratti*, Ricardo, in colouring but it is at once distinguished by the black antennae and black palpi, and by the more hyaline wings, quite clear at apex. Length 17mm.

Face brownish yellow, paler at base, with a few black hairs, the bright orange-red pubescence is here confined to the beard. Palpi blackish with black pubescence more pointed than in *T. pratti* (stout, almost the same width throughout). Antennae wholly black, the first two joints with black pubescence, the third broad at base with a perceptible tooth. Subcallus brown. Forehead ashy grey, narrow, the same width throughout and about seven times as long as it is broad, the frontal callus black, almost the same width throughout to within a short distance of the vertex, very similar to that of *T. pratti* (long and narrow, almost reaching the eyes with a long stout linear extention). Thorax and scutellum in this species bluish black, with ashy grey tomentum, devoid of pubescence on dorsum, sides with long black hairs; breast with similar orange-red pubescence to that of *T. pratti* (with dense orange-red long pubescence). Abdomen black with median white-haired spots, the segmentations white-haired at the sides only, pubescence on the dorsum black; under side black with white segmentations. Legs black with black pubescence, some yellow hairs on the fore coxae and tomentum on the others. Wings marked with dark rich brown colouring, most intense on fore border and across middle of wing, leaving the discal cell all however clear, and not extending beyond the base of fork of third vein, so that the apex is wholly clear, posterior border almost wholly clear, veins and stigma blackish, no appendix

present. Halteres brown. Described from only one female from Pankio (Formosa).

I have no specimens, but saw this type in the British Museum a few years ago. It is much more closely allied to *T. sauteri*, Ricardo, than *pratti*, Ricardo, and I thought this species might be a local or seasonal variety of the former. I am, however, obliged to take the name of *fuscicornis*, as the specific one, until a number of this form is collected. *T. fuscicornis* may be distinguished from *sauteri*, by its broader frontal stripe and consequently broader frontal callus, by its much more greyish thorax almost bare from pubescence (probably denuded), and by its darker coloured wings; these characters sometimes appear in *T. sauteri*.

23. Tabanus sauteri, Ricardo. (Pl. VII. fig. 4).

(Kuro-bane-Miyama-Abu)

Ann. Hist.-Nat. Mus. Nat. Hung., XI, p. 171, 1913; Suppl. Entom., III, p. 64, 1914.

A blackish medium-sized species with a row of greyish white or yellowish triangles and the similar-coloured bands on the black abdomen, with the brown wings and the blackish legs, and with the very long (from just above the frontal triangle to near the vertex) brownish black frontal callus on the narrow nearly parallel-sided frontal stripe.

Female. Head rather large, broader than the thorax, moderately arched. Frontal stripe rather narrow, nearly parallel-sided but inconspicuously narrowed towards below, about seven times as long as its narrowest part (I have not seen the species which has so narrow frontal stripe as Miss. Ricardo described in Ann. Mus. Hung., XI, p. 171, 1913) or about five and a half times as long as its broadest part, clothed with yellowish brown tomentum which becomes yellowish grey on the upper part, and covered with very short somewhat conspicuous black pubescence which extends nearly throughout the whole length of the frontal stripe and becomes more conspicuous about the middle and

on the vertex; frontal callus brownish black shining, comparatively convex, oblong and slender, quite separated from the eye-margin by the rather broad (still narrow) intervals, with a very long and linear though conspicuously broad extension which is also raised and extends near the vertex, and this extension usually being sharply pointed above and about three times as long as the callus proper; vertex without tubercle and ocelli, covered with somewhat numerous erect curved black pubescence which grows up a little longer behind; frontal triangle about half as long as it is broad, clothed with yellowish brown tomentum, the middle part more or less conspicuously elevated roundish and with a fine sulcus which extends from the upper extremity to below the antennae. Face moderately convex, covered with greyish yellow tomentum which becomes brownish on the upper part of the cheeks especially along the eye-margins; epistoma apparently broader than the length, with two deep and narrow lateral pits, on the upper lateral corners and about the middle there are some short conspicuous black hairs of which those on the middle part are much fewer and much shorter; cheeks covered with a few short scattered inconspicous black pubescence which is more conspicuous near the eye-margin and about the upper part, and this black one extends a little below to the jowls covered with numerous dense long yellowish hairs which extend up a little to the back of the head; postocular margin with a narrow greyish yellow bare rim which becomes narrower towards the upper angle and broader into the jowls, and behind which is a rather long (still short) and somewhat overlapping ciliation of bristly black hairs which extend a little behind to the hollowed-out portion of the greyish yellow back of the head on where there are some scattered pale hairs and below into the jowls. Proboscis rather long and stout, shorter than the depth of the head, brownish black, the hind margin of the stalk furnished with some moderately long erect blackish pubescence which becomes conspicuously dense at its apex; sucker-flaps short and stout, about a half as long as the proboscis, covered with some

scattered yellowish or dark brown bristly hairs which are about as long as or shorter than those on the stalk. Palpi brownish black or black, narrow; first joint very narrow and short, about fourth as long as the end joint covered with yellowish tomentum but blackish about the tip, bearing numerous long yellowish soft pubescence with shorter black hairs intermixed about the apical half of the outside; second very narrow and long, wholly four times as long as its broadest part, about the basal thirds more or less broadened and then drooping and gradually narrowed but very slightly to a short point, covered with some greyish tomentum but quite obscured by numerous tiny depressed black pubescence on the whole outer and upper surface. Antennae blackish or reddish brown, with the style-like portion dull black or brownish black; first joint nearly cylindrical but more or less thickened apically about one and a half times as long as its thickest part, covered with some yellowish grey tomentum and abundant tiny black pubescence which becomes sparser beneath but grows up longer about the top of the underside; the upper apical margin slightly produced before; second joint small and about half as long as the first joint, with a rather long apical prolongation and with an incomplete circlet of very tiny black bristly hairs which becomes longer incomplete circlet of very tiny black bristly hairs which becomes longer beneath, usually the same colour as the basal annulation of the third joint but sometimes conspicuously obscured by a greyish tomentum; third joint about three times as long as two basal joint together, the basal joint conspicuously broadened and about one and a six-tenth times as long as its broadest part, near the base with a distinct tooth crowned with tiny black bristles; the style-like portion apparently shorter than the basal broad annulation of third joint, rather stout, the apical annulation somewhat elongate conical, and about one and a half times as long as the preceding one, the other three annulations subquadrate and bearing one or two inconspicuous pubescence about the tops. Eyes bare, with the facets practically equal in size but very inconspicuously large in front in careful examina-

tion, in death deep greenish black with some shimmer in a certain light; when seen from above the frontal margin about four-fifth as long as the hind margin, forming the upper angle about 100° with the hind margin which is very slightly concave, the outer margin slightly convex and the frontal angle about 55°; in profile about one and a half times as deep as long, irregular ovate, the frontal margin strongly curved below, while the hind margin is moderately convex; when seen from front the frontal margin wholly one and a half times as long as the facial margin which is slightly convex at the lower third and is forming a roundish lower angle about 110', the frontal angle about 140 and the upper angle nearly 90°, the outer margin evenly and broadly rounded.

Thorax roundish, slightly shorter than the width, brownish, covered with yellowish grey or grey tomentum especially on the anterior part at where there are three narrow indistinct brownish median stripes which do not extend behind the suture, the sides rather greyer; pubescence on the disc short depressed, golden yellow or yellowish, intermixed with more numerous longer sloping or suberect black hairs which rapidly become sparser about the anterior vertical portion and then displaced with yellowish ones below, and which grows up longer about the sides especially on the space between the humeri and the praealar calli; humeri conspicuously yellow or sometimes yellowish grey, covered with rather long yellowish hairs on the lower half but with shorter though stouter black ones on the upper half; praealar calli conspicuous, covered with dark grey tomentum which becomes yellowish or whitish above, and clothed with numerous long conspicuous black hairs which becomes more dense and bristle-like on the lower margin and is intermixed with yellow pubescence about the upper corner; postalar calli haired as on the disc of thorax but the black hairs longer, and bearing a long conspicuous golden yellow tuft on the outer margin, the hairs formed this tuft becoming paler (greyish) at the anterior extremity; the upper base of the wing with a long tuft of golden yellow hairs which are shorter than those on the postalar

calli. Scutellum moderate in size, somewhat triangular with the rounded angle, brownish but usually greyish rounded the posterior margin, covered with abundant golden yellow or yellowish pubescence which is intermixed with longer sloping black hairs. Pleurae densely clothed with greyish yellow tomentum, and covered with long soft yellow or orange yellow pubescence which becomes dense and longer on the upper part; on the posterior-upper margins of the meso- and metapleurae there are long shaggy yellow or reddish yellow tufts; the triangular membrane between the prothorax and mesopleurae distinctly deeper coloured, and with a rather large stigma which has the reddish brown or brown margin.

Wings large, longer than the thorax and abdomen together, brown, becoming paler on the posterior border and at the apex, which sometimes is rather broadly quite clear or sometimes only second submarginal cell; the base and apex of the marginal cell usually hyaline but the apex sometimes brown; stigma dark brown, veins blackish brown, and the hyaline spot on the discal vein more or less distinct; posterior cells all widely open, anal cell closed a little before the margin, and discal cell moderately large and slightly or apparently longer than the second posterior cell; the upper branch of the cubital fork without the recurrent veinlet. Squamae in the alar pair glassy grey with a blackish margin and short yellowish brown fringe except for the considerably long whitish tuft about the angle; in the thoracal pair brownish with a brown margin and a inconspicuous brownish fringe. Halteres dark brown, with the apex paler or sometimes with the stalk paler.

Legs dull black with the coxae obscured by greyish yellow tomentum; front coxae moderately dilated, longer than two-third the length of the front femora, darkened apically and inwardly, covered with abundant long black pubescence but on the outer basal half there are more dense mucn longer yellow or whitish yellow hairs; front femora covered with numerous black pubescence except on the broad shining blackish subfemoral bare space which is slightly hollowed out about the

basal thirds and is inconspicuously transversely striolate throughout, the inner margin of this bare underside bearing a dense but short ciliation of black bristly hairs, and on the outside of the femora there is a dense and long conspicuous broad black fringe ; middle femora covered with dense sloping black pubescence, which grows up longer on the inner-lower side and is intermixed with some golden yellow hairs about the base or sometimes throughout the whole underside ; hind femora covered with numerous but shorter black pubescence and sometimes with some golden yellow hairs intermixed on the upper and lower surfaces ; front tibiae not dilated but curved as usual, covered with dense tiny black bristly hairs, two pairs of the posterior tibiae covered with dense longer black pubescence, and the middle pair bearing two rather long and slender blackish spurs with the base reddish ; tarsi covered with black pubescence, with more or less reddish soles ; pulvilli yellowish brown, and claws black, with the base reddish.

Abdomen rather flat, conspicuously broader than the thorax, and a little longer than or about as long as the head and thorax (including the scutellum) together, with the anal apex broadly rounded, black with narrow grey or yellowish grey tomentose bands on segments, widening in the middle of the second to a large triangular spot, but in the following ones only appearing as small truncated spots ; the sides of the basal two segments broadly yellowish brown, with grey or yellowish grey dust, but the remaining sides hardly pale ; pubescence on the greyish spots and bands glistening whitish or yellow. Ventre blackish, moderately shining, with the first two segments brownish and obscured by greyish yellow or greyish tomentum, and with broader bands not extending into median spots ; pubescence mostly black but on the basal two segments and on the bands golden yellow or whitish, on the seventh segment there are some longer and stouter sloping black bristly hairs which somewhat extend up to the preceding one or two segments about the middle.

Length : 15-16.5 mm.

Male. Similar to female. The large facets of eyes hardly reach the vertex, but attain the base of the frontal triangle. Antennae have the third joint reddish. Wings with the dark colour less extended, leaving the apex quite clear.

The male is not known to me.

This handsome species is easily distinguished from any other Japanese species of *Tabanidae* except the preceding species, by its brown wings and its distinctly yellow pleurae, and from the *fuscicornis* it may be known in the several minor points mentioned already. It varies a little in the colouring of the thorax, abdominal bands or spots, and wings, as described above; the yellow pubescence on the thorax is not noted by Miss Ricardo, but I think that the type may be one of nicely denuded specimens, as I have many of such materials which quite agree with her co-type in the British Museum; the golden yellow hairs on the middle femora vary in distinctness, those of the specimens from Arisan being vary conspicuous, while those of the materials from Banshorio are usually hardly existing.

T. sauteri is an uncommon Formosa insect, though it can almost always be found in small numbers in some localities of mountainous districts (Taipin-July, Sokutsu-June, Banshorio-June, Fuhosho-June, and Arisan-June).

I have taken the females on the road between bushes about 3 o'clock in the afternoon, and I have bitten by them several times, but the effects were not very continuous.

24. Tabanus sanguineus, Walker. (Pl. VII, fig. 6).

(Taiwan-shiro-sune-Abu).

Ins. Saund., Dipt., I, p. 54, 1850.

V. d. Wulp, Cat. Dipt. South Asia, p. 60, 1896.

Kertesz, Cat. Dipt., III, p. 277, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 194, 1911; Ann, Hist.-Nat. Mus. Nat. Hung., XI, p. 170, 1913.

Atylotus assamensis, Bigot, Mem. Soc. Zool. France, V, p. 653. 1892.

Tabanus assamensis, V. d. Wulp, Cat. Dipt. South Asia, p. 63, 1896.

Kertesz, Cat. Dipt.; III, p. 222, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 194, 1911.

A blackish rather broad medium-sized species with two rather broad hardly separated callus on the broad frontal stripe, with five wide greyish stripes on the thorax, with a series of grey triangles and rather broad bands on the blackish abdomen, and with conspicuously whitish grey tibiae.

Female. Head slightly broader than the thorax, moderately arched; frontal stripe yellowish grey but reddish brown about the middle and the vertex, covered with rather numerous yellowish grey pubescence which is intermixed with abundant short brown hairs on the darker parts, and slightly narrowed below and five times as long as its narrowest part or about four times as long as its broadest part; lower frontal callus reddish brown, moderately convex, large, subquadrate, usually longer than width, only separated from the eye-margin by very narrow brownish lines but connected below by a very short point with the upper callus; the upper callus similarily coloured and raised, but slender and longer, about one and a half times as long as the lower callus and wholly three-fifth as wide as that; frontal triangle rather large, covered with a light grey tomentum but slightly tinged with pale yellowish brown along the suture which separates the cheeks from the frontal triangle, rather flat but very slightly raised below near the antennal fossae, with a very fine but more or less conspicuous median sulcus; vertex broader than long, irregularily longitudinally striolate, covered with a grey tomentum but slightly obscured by a short brown or blackish pubescence. Face clothed with light grey tomentum which becomes very slightly yellowish about the upper corners of the cheeks, covered with rather abundant and long whitish

pubescence which is straight, sloping and longer on the broad epistoma, while the pubescence on the cheeks is shorter, more numerous, sub-erect and slightly curved about the tip, which becomes much longer, more denser, and shaggier on the jowls; back of the head moderately hollowed out, clothed with grey tomentum, and bearing rather abundant but scattered whitish pubescence which becomes more numerous and more conspicuous on the lower half; postocular bare rim narrow about equal in width throughout, and whitish grey tomentose, behind which is a short but conspicuous dull yellow ciliation which grows a little longer right up to the upper eye-angle and extends a little below to the jowls and behind that a more abundant longer greyish ciliation which becomes more conspicuous on the upper part; behind the vertex there are some slightly longer black hairs, which have their tips bent forwards and are some inconspicuous grey hairs intermixed on and about the vertex. Proboscis short and stout, about half as long as the depth of the head, dull black, bearing abundant long yellowish grey pubescence on the hind surface of the stalk and a longer conspicuous pale tuft at its apex; sucker-flaps very large, about two-thirds as long as the proboscis, the lower surface furnished with rather abundant but scattered shorter dull yellowish brown bristly hairs which are intermixed with some similar but blackish and more shouter hairs. Palpi rather short and stout, yellowish or light reddish brown obscured by a light greyish tomentum which becomes slightly darker about the base of the end joint and on the basal joint; first joint narrow and about thirds as long as the second joint, slightly thickened about apical half, covered with a long dense whitish grey pubescence; second joint stout about the basal half and then drooping and gradually narrowed to a point, about two and a seven-tenth times as long as its thickest part, covered with numerous short depressed whitish grey pubescence which becomes longer about the base of the underside, and on the upper side there is some similarily short but black one intermixed, the black pubescence being numerous and more conspicuous about the top where

the whitish one nearly absent. Antennae dark reddish brown or dark yellowish brown, slightly covered with a greyish tomentum on the first two joints; first joint stout and moderate in length, thickened apically and with a short broad blackened apical dorsal process, clothed with numerous fine and short black pubescence which becomes slightly longer about the apex of the underside, and with some long pale hairs intermixed almost through the underside and about the base of the outside second joint very small and about thirds as long as the first joint, with a rather long and narrow apical process, and an incomplete circlet of very tiny black bristly hairs which are only conspicuous on the underside; third joint very slightly broader than the first joint and about three times as long as the second and third joints together, darker with the style-like portion blackish; the first annulation of the third joint about as long as the following annulations together and about one and a half times as long as its broadest part, and with a rather flat dorsal hump near the base, the hump more or less crowned with a very few minute black bristly hairs; the style-like portion rather long and slender, the basal three annulations each slightly longer than the width, but the apical one wholly one and a half times as long as just preceding one, these four annulation bearing one or two minute inconspicuous pubescence about the top of each annulation. Eyes quite bare, with he facets equal in size, in death deep purplish black with a coppery shimmer in a certain light; when seen from above rather flat triangular, the frontal margin about two-thirds as long as the hind margin which is almost straight throughout but somewhat convex at the outer end where the outer angle is about 65° and is narrowly rounded, the upper angle about 110° and the outer margin moderately convex after the middle; in profile long oval, about three-fifth as wide as the depth, the frontal and posterior margins almost equally but slightly convex and the lower margin strongly curved below; when seen from front about as wide as depth, the frontal margin longer than the facial margin, the frontal angle about 135°,

the upper angle about 90°, and the lower angle about 130° and rounded.

Thorax rather roundish, a little broader than the length, blackish brown with a slight reddish tinge, with five rather broad grey stripes of which the middle three are more distinct before the suture especially the narrow middle one only extending a little after it, covered with greyish tomentum and with numerous short and suberect black pubescence which becomes very sparse near the apical vertical portion where there are numerous longer greyish hairs, and which is intermixed with abundant much shorter depressed yellowish grey hairs throughout the disc especially on the stripes and about the suture conspicuous; humeri pale dull yellow obscured by long soft whitish grey pubescence; praealar calli pale reddish yellow obscured by a grey tomentum and covered with abundant yellowish grey pubescence intermixed with some scattered longer black hairs which grow up considerably longer and exeedingly dense at the lower margin where they cause to form a conspicuous black fringe; the space between the humeri and praealar calli covered with numerous and dense long shaggy yellowish grey hairs, but on the upper part there is almost only short black pubescence; postalar calli paler than the disc, clothed with rather whitish short pubescence intermixed with some black hairs, and bearing a rather conspicuous whitish grey tuft of dense somewhat long hairs on the posterior margin, the similar tuft though shorter on the upper base of the wing more or less conspicuous; scutellum paler than the thorax, covered with grey tomentum and with numerous whitish grey or yellowish grey pubescence which is intermixed with some scattered black hairs on the upper half especially on the middle part, and bearing a more or less conspicuous short fringe of whitish hairs on the margin. Pleurae covered with ashy grey tomentum, and bearing numerous dense long soft whitish pubescence which becomes a little longer on the upper part and is intermixed with some inconspicuous black hairs on the upper half of the mesopleurae; on the prothorax

and on the postero-upper margins of the meso-, ptero-, and meta-pleurae, there are long and dense conspicuous whitish tufts in which the former is slightly sparser.

Wings clear, with the veins brown in which the costal and sub-costal veins conspicuously darker; stigma yellowish; all the posterior cells widely open, but the first one more or less contracting at the wing-margin; discal cell very large, and about one and a half times as long as the second posterior cell; anal cell closed with a rather long petiole; upper branch of the cubital fork without the recurrent veinlet. Squamae glassy grey with a dark brown margin and a yellowish brown fringe of very short hairs excepting for a long whitish grey tuft about the angle between the alar and thoracal pairs; halteres brown with the knob milky white except the base reddish brown.

Legs blackish, all tibiae with the exception of the apices and of the extreme bases pale yellowish or whitish; front coxae moderately dilated and wholly two-thirds as long as the front femora, covered with ashy grey tomentum which becomes rather scarce about the apex, and clothed with numerous and dense whitish grey pubescence which grows up much longer towards the base; front femora very slightly dusted with greyish excepting on a broad shining subfemoral bare space which is transversely striolate and is hollowed out about the apical thirds, inner margin of this bare space bearing a comparatively long ciliation of rather dense black bristly hairs, pubescence on the outside long and dense yellowish grey or whitish grey with some stout black hairs intermixed near the subfemoral bare space especially about the base, and pubescence on the rest black and short; two pairs of the posterior femora more or less covered with greyish tomentum, and clothed with somewhat long yellowish pubescence which is intermixed with some black short hairs on the underside especially in the middle pair conspicuous, and which becomes shorter towards the apex; front tibiae not dilated but very slightly curved, covered with short whitish pubescence but on the blackish apical two-third there is black one which

extends very sparsely towards the base along the pale reddish brown underside; middle tibiae about apical fifth blackish and bearing short black pubescence which on the rest is whitish, on the outer-upper margin there is an inconspicuous ciliation composed of four or five long whitish hairs, the apical spurs stout and rather short, blackish; hind tibiae about the apical thirds blackish, pubescence on the pale portion pale yellowish and depressed as in the other tibiae, and pubescence on the blackish part very short and black which extends towards the base along the innerside, on the upperside there is a somewhat long conspicuous outer fringe composed of black and pale yellowish hairs in which the black hairs are on the blackish part of the tibiae and others on the rest, but the separation is not conspicuous, while the lower fringe is shorter and is composed of black hairs nearly throughout; tarsi all deep black, covered with numerous dense short black pubescence which on the underside of two posterior pairs has a reddish shimmer in a certain light; pulvilli dull yellowish brown or reddish brown; pale hairs on the legs all with a silvery shimmer in a certain light; claws black, with the base reddish.

Abdomen broader than the thorax, and gradually but very slightly narrowed towards the apex which is very broad and is nearly transversely straight, slightly longer than the head and thorax (including the scutellum) together, blackish. Dorsum darker than the underside, with whitish grey haired segmentations on a grey tomentose border, enlarged in the middle as broad triangular spots, and at the sides wider and more conspicuous, the middle triangles hardly reaching to the anterior margin of the segments of which the first one is very flat and is not triangular, while the seventh segment bears no triangle nor band; pubescence on the rest black except about the sides at where it is whitish grey as that on the bands and spots, especially on the first two segments which have rather broad greyish tomentose sides. Ventre covered with ashy grey tomentum except on about the middle thirds with blackish brown one, clothed with black pubescence

which becomes whitish on the broad lateral parts especially on the first two segments more conspicuous ; seventh segment bearing abundant long curved black bristly hairs which somewhat extend on the preceding two segments but quite sloping.

Length : 18-21 mm.

This handsome species is easily distinguished from the other Japanese species (except *T. miyajima*, Ricardo.), by its distinctly whitish tibiae, by its hardly separated frontal callus on the broad frontal stripe, by its clear wings, by its rather broad whitish haired bands or median triangles on the abdomen, and by its five rather broad somewhat conspicuous grey stripes on the thorax ; and is distinguished from *T. miyajima* by its brownish colouring, by its five or six whitish median triangles, and in other minor points.

According to the description of Bigot, *T. leucosparsus* may be a synonym of this species, and his type might be a denuded specimen. A female Kankau (Formosa, September) in the British Museum, arranged by Miss Ricardo, as *T. leucosparsus*, has no distinguished characters, though it differs by a dark colouration, a fine but conspicuous carina at the middle of the upper callus of the frontal stripe, and a few irregular blackish punctuations at the pleurae which are denuded. I could not separate it from *T. sanguineus*, Walker, and if her identification is correct there is no doubt that the species is the same as the latter.

This fly has rather a wide distribution, as I have records from Java, Federate Malay States, Sumatra, Burma, Assam, China, and Formosa, but it is rather a rare species in the Island of Formosa and its occurence is quite restricted to the southern parts from Takao to Koshun, where it emerges during June and July. I took only two females on the road near the sea shore of the Bosan district, about four o'clock in the afternoon. The male is not known yet.

25. **Tabanus miyajima**, Ricardo. (Pl. VIII, fig. 1).

(Shiroashi-Abu or Shiro-sune-Abu)

Rec. Ind. Mus., IV, p. 250, 1911.

Tabanus albotibialis, Matsumura, Thous. Ins. Japan, Addit., vol. II, p. 382, Pl. XXII, fig. 11, 1916.

A blackish medium-sized species with distinctly whitish tibiae; in the female with whitish-haired abdominal bands, most prominent on the fourth and fifth segments where they are produced in the middle as triangular spots, with a rather large blackish callus on rather broad whitish or yellowish grey frontal stripe, and with faint greyish stripes on the greyish black thorax; in the male with brownish black thorax without any stripes, with only two conspicuous white-haired abdominal bands, and with quite clear wings.

Female. Head slightly broader than the thorax, and very slightly arched behind. Frontal stripes whitish or yellowish grey, not parallel-sided but contracting towards the inner and upper angles of the eyes, and about the part between the vertex and prolongation of the frontal callus broadest, moderately broad and wholly five times as long as its narrowest part or about three and a four-fifth times as long as its broadest part; pubescence on the frontal stripe moderately long and conspicuous, mainly blackish brown but on the lower half yellowish white; frontal callus brownish black, moderately convex, club-shaped, long, stout, not reaching the eye-margins, prolonged in a stout short linear extension; vertex blackish, covered with inconspicuous short blackish pubescence, and with an inconspicuous trace of the ocelligerous tubercle. Frontal triangle covered with yellowish grey or pale yellowish brown tomentum which becomes suddenly brownish on the lunules just above the antennal fossae, in the middle there is a distinct but fine longitudinal sulcus through the whole length. Face covered with greyish tomentum and with some silvery white pubes-

cence; epistoma broad, about as long as wide, nearly parallel-sided, with the very shallow lateral pits, and with the pubescence sloping and not dense; cheeks even at the broadest part less than half the width of the epistoma, the tomentum on the upper part and the sides pale yellowish brown, and the pubescence mostly whitish and longer than in the epistoma but on the brownish part brownish black and shorter; pubescence on the jowls abundant and dense, silvery white or whitish, which extends up a little to the back of the head where the surface is slightly hollowed out and is covered with whitish grey tomentum and with some short scattered whitish pubescence; postocular rim moderately broad, becoming narrower towards the lower part and near the vertex, greyish, behind which there is a rather conspicuous black ciliation intermixed with numerous pale yellow pubescence which extends into the jowls; behind the vertex there are some black curved hairs which are longer and much conspicuous more than those on the vertex. Proboscis rather stout, brownish black shorter than the depth of the head; the stalk furnished with numerous white pubescence and with some blackish bristly hairs about the margin of the apical part; the sucker-flaps about and longer than the stalk, bearing some short scattered brownish black bristly hairs. Palpi moderately long and stout, yellowish brown at the inside and reddish brown at the outside but obscured by a dark greyish tomentum, nearly as long as the proboscis which is in the rest; the first joint narrow and long, covered with a dense grey tomentum and with numerous pale yellowish white pubescence which is as long as that on the jowls; the second joint a little longer than twice the first joint, and wholly four times as long as its broadest part, the basal third broadest and then drooping and gradually narrowed to an obtuse point, covered with numerous very short black bristly hairs intermixed with some yellowish grey pubescence along the upper margin and about the basal part where the black hairs are almost absent. Antennae dull brownish, with the third joint somewhat paler; first joint stout, gradually thickened towards

the apex which is forwardly produced at the upper side, longer than its thickest part, covered with numerous short black bristly hairs, and at the lower apical and outer lower margins there are some longer bristles; second joint very small, somewhat paler than the basal joint, with a long and narrow conspicuous at the upper apical margin and with a complete apical circlet of short black bristles which become slightly longer at the underside; third joint about twice as long as two basal joints together; the basal annulation of the third joint at the broadest part about as wide as the thickest part of the first joint, and about one and a four-fifth time as long as its broadest part where there is a rather small but conspicuous tooth, the upper margin well concave at the part after the dorsal hump, and the lower margin slightly roundly produced beneath; the style-like portion apparently shorter than the broad basal annulation of the third joint, the first two annulations about the same in length and very short and transverse, the third one slightly longer but still shorter than its width, and the apical annulation slender and long, about as long as the preceding two annulations together, pointed at the top where there are one or two conspicuous but quite minute hairs. Eyes in death deep black or deep purplish black or sometimes deep greenish black, without any marks or bands; when seen from above the posterior margin nearly straight and about one and a half times as long as the frontal margin, and outer margin moderately convex, the inner angle about 100°, the frontal angle about 55°, and the outer angle about 80° and rounded; in profile ovate, the frontal margin slightly convex, the posterior margin longest and curved posteriorily, and the facial margin shortest and moderately convex, forming a rounded lower angles about 90° with posterior margin, the frontal angle about 130° and rounded, and the upper angle about 80°; when seen from in front about as wide as deep, the frontal margin very slightly longer than the facial margin which is almost straight but the lower end slightly convex, and the outer margin strongly curved outwards, forming a large rounded outer

angle with itself, the frontal angle about 135°, the upper angle about 90°, and the lower angle about 100° and rounded.

Thorax stout and roundish, about as long as wide, black, covered with greyish tomentum, and bearing four indistinct but rather broad stripes in which the middle two more inconspicuous and obscurely fused from one another leaving only a very faint line black median stripe about the anterior half, while the lateral two are rather well-defined and extend from the humeri to the postalar calli, passing on the praealar calli; pubescence on the disc short depressed yellowish, intermixed with abundant short erect black hairs which become somewhat longer and sloping and paler about the anterior part, the yellowish pubescence conspicuous only in the well-preserved specimen; humeri obscured by whitish grey tomentum and covered with long greyish hairs; praealar calli moderately covered with grey tomentum and furnished with numerous long black stout hairs on the lower half but on the upper half shorter curved yellow hairs which usually extend on the part between the humeri and praealar calli; postalar calli slightly reddish, obscured by a grey tomentum, covered with short black and yellowish hairs, and furnished with a moderately long dense tuft of whitish hairs at the posterior margin, the similar but smaller tuft just above the wing-base; scutellum rather large, somewhat semicircular, covered with dense whitish grey tomentum, and with yellowish pubescence which becomes longer whiter and much denser along the margin. Pleurae black, but quite obscured by a whitish grey tomentum, and covered with white pubescence which is intermixed with a few inconspicuous but stout black hairs on the mesopleurae; on the postero-upper margins of the meso- and meta-pleurae there are conspicuous white tufts of long somewhat shaggy hairs, and on the prothorax and pteroplearae there are abundant long white hairs all over the surface.

Wings hyaline, but slightly obscured by a pale greyish tinge and shaded with yellowish brown tinge on the cross-veins; veins brown of which the mediastinal and postical veins somewhat yellowish; costa

and anal cells and the base yellowish, stigma brown; all the posterior cells widely open, discal cell moderately in size, longer than the second posterior cell, and anal cell closed with a moderately long petiole; upper branch of the cubital fork without the recurrent veinlet. Squamae in the alar pair grey with a brown margin and a short but conspicuous pale brown fringe excepting of the long pale yellowish white tuft about the angle; in the thoracal pair brown with a dark brown thick margin and an inconspicuous yellowish brown ciliation of very fine hairs. Halteres blackish brown with the apex of the knob reddish.

Legs black, with the tibiae whitish at the basal half or more; fore coxae slightly dilated, longer than half of the fore femora, covered with a greyish tomentum about the basal two-thirds where the pubescence is long and white, but on the rest distinctly shorter and black; fore femora covered with blackish grey tomentum, leaving a rather broad shining bare subfemoral space which is slightly hollowed out about the apical half or more and is finely striolate transversely, the remaining part covered with short black pubescence and on the outside with a long conspicuous black fringe, the ciliation at the inner margin of the subfemoral space moderately short and rather dense composed of rather fine hairs; middle femora mainly covered with black pubescence which is conspicuously long at the outer side and which is intermixed with some whitish hairs at the upper apical part and about the outer basal half; hind femora covered with somewhat longer black pubescence all over the surface, which becomes much longer on the underside as a distinct fringe, and which is intermixed with some silvery white hairs all over especially on the underside much conspicuous; fore tibiae at the apical half and the base brownish black or black and covered with numerous short black pubescence, the rest pale yellowish white left the narrow underside blackish brown and bearing white pubescence which becomes longer at the outside and is inconspicuously intermixed with a very few scattered minute black hairs on the upper half; posterior two tibiae at the apical third and the extreme base

brownish black or black and covered with short numerous black pubescence excepting the extreme base almost bare from hairs, the rest pale yellowish white and with pubescence intermixed with very few scattered inconspicuous black hairs, these hairs on the hind tibiae longer than those on the middle one which bears two unequal brownish black rather short spurs, and at the outside of the former there is a long conspicuous fringe; tarsi all black, covered with short dense black pubescence, and bearing black claws and dull yellowish brown pulvilli.

Abdomen stout, broader than the thorax, and longer than the head and thorax (including the scutellum) together, slightly narrowed towards the anal end where it has broad rounded margin. Dorsum black, very slightly obscured by a brown tinge, with distinct grey tomentose rather broad bands on the posterior borders (through the whole width) of the segments except on the seventh segment, covered with close black pubescence which on the sides (about the lateral fourth of the grey bands) of the first three segment, and on the middle thirds of the grey band of the fifth segment is silvery white; the silvery white pubescence on the fourth and fifth segments extending in the middle as a short triangle not reaching the anterior borders. Ventre black, covered with grey tomentum and short silvery white pubescence which is intermixed with some inconspicuous blackish hairs about the middle thirds on the basal four segments, and which becomes wholly black on the last three segments.

Length: 17.5-19 mm.

Male. Browner, the abdomen somewhat conical without grey tomentose bands, the wings quite clear, the scutellum brownish black similar to the thorax which has no stripes, and the fore tibiae more or less yellowish only about the basal third.

Head large, broader than the thorax and a little shorter than it, more arched than in the female. Frontal triangle somewhat elongate triangular, bark brown, slightly elevated in the middle where there is an indistinct fine sulcus which is only conspicuous about lower half.

Face brown, bare on the sunken epistoma but with long fairly dense erect and fine black pubescence on the inflated broad cheeks which are nearly equal in width throughout the whole length; pubescence on the lower part of the cheeks, at the back of the mouth, and on the jowls longer and somewhat shaggy; the bare rim under the eyes dark yellowish brown; back of the head with a very narrow black bare postocular rim which at the temple region is practically sunk behind the eyes, and behind which is a very short very inconspicuous black ciliation which hardly grows longer near the top angle of the eyes and which has absolutely no long o[illegible]hanging or outstanding hairs, but in some lights the short ciliation on the temple region is almost yellowish; vertex very small, slightly raised, deep yellowish brown, nearly almost bare, but behind the vertex there is some short rather inconspicuous black pubescence which is not overhanging and is not nearly long enough to constitute a tuft. Proboscis short and stout, nearly black but very slightly obscured by dark brown tomentum; the stalk with rather numerous long black hairs behind; the sucker-flaps large, about twice as long as the stalk, furnished with some somewhat long scattered black bristly hairs beneath. Palpi brown, slightly obscured by a yellowish brown dust; first joint three-fourth as long as the second and narrower than it, covered with long blackish brown pubescence; end joint oblong ovate, bladdery, about twice as long as its thickest part which is a little before its middle, and ending in a rather sudden blunt conical or sometimes evenly rounded tip, and usually with a slight compression at the inner side just before the tip, widely clothed on its outer-upper part with long soft blackish brown pubescence of which there is sometimes some indication on the underside, but the lower half of the outside, sometimes all the underside, and all the tip with numerous (almost dense) not very short black bristly hairs. Antennae paler than in the female, dull reddish; first joint obscured by a yellowish tomentum, stout and short, about as long as its thickest apical part, extended like a hood over the second joint, and bearing

on all its upper side dense short black bristles, while on its underside are longer hairs; second joint small, about one-thirds as long as the basal joint, with an apical dorsal process slightly shorter than the joint proper, and with an incomplete apical circlet of black bristles which are short on the upper side but rather longer on the underside; third joint narrower than the basal joint, with only a small blunt dorsal hump on the basal quarter and usually with a few tiny black bristles there; style-like portion about three-fourth as long as the basal annulation of the third joint, with three basal annulations about the same in length and about as wide as long, but the apical annulation elongate conical and about twice as long as the preceding one and bearing one or two fine but somewhat conspicuous hairs. Eyes bare, large, convex, in death brownish black on the large facets and deep purplish black on the small facets; when seen from above the frontal margin about as long as the posterior margin which is nearly straight, and the outer margin evenly convex, the upper angle about 100° and slightly rounded; in profile the frontal margin slightly convex, the facial margin also slightly convex and shortest, and the posterior margin longest and moderately curved posteriorily about the middle, the frontal angle roundish and about 110°, the upper angle smallest and about 70°, the lower angle rounded and about 90°; when seen from in front the frontal margin longer than the facial margin which is slightly convex and forming a frontal angle about 140° with it, the outer margin strongly and evenly convex, having the upper and lower angles both about 90°; facets on nearly the upper two-thirds much larger (about five times) than those on the lower part, and the large facets extend upwards just before the vertex and downwards beyond the junction of the eyes, while the small facets extend in a narrow zone up along the back margin and the contrast in size is rather conspicuous there; the horizontal dividing line between the large and small facets is not straight but slightly undulating and is rather well-defined.

Thorax brower than in the female and with longer pubescence

which is almost entirely black and without the depressed yellowish hairs except about the suture ; the greyish stripes disappear ; pubescence on the pleurae more abundant and blackish, but the tufts on the postero-upper margins of the meso- and meta-pleurae somewhat yellowish ; scutellum brownish like the thorax with rather thick brownish black pubescence all over.

Wings, squamae, and halteres as in the female, but the first ones quite clear with the veins pale brown, and middle ones with the yellowish tuft about the angle.

Legs as in the female, but the fore tibiae only yellowish white on the basal third ; the pubescence longer and denser.

Abdomen longish, and flat conical. Dorsum without the greyish tomentose bands, but on the fourth and fifth segments there are not very conspicuous silvery white haired bands along the posterior borders, these two bands extending in the middle as a short much smaller triangle of which the posterior one is not reaching the sides, the resting pubescence black excepting on the posterior margins of the nearly lateral thirds of the first three segments yellowish brown, and more denser and longer (but still short) than in the female. Ventre much black more than in the female, slightly covered with a greyish tomentum, bearing black pubescence and on the very narrow posterior margins of the second, third and fourth segments there are some short white hairs excepting of the middle part especially on the fourth ; seventh segment about the middle with rather long erect black bristly hairs which do not extend up to the preceding segments.

Length : 18-18.5 mm.

This species is one of the handsomest flies, and has no ally in the Paraearctic or Oriental region, but it has a general resemblance to the Malayan *Tabanus significans*, Ricardo. *T. miyajima* may be distinguished in both sexes from any other of our species, by the only two flat silvery white haired median triangles. It has been described from a male taken Miss Pascoe in Japan, 1896, and a series of the

females collected by Dr. K. Miyajima, in Tokio, 1909; unfortunately these types preserved in the British Museum are not complete specimens, but much damaged and rather denuded. The original description does not, therefore, agree with the fresh materials in minor points, especially on the pubescence of the thorax, scutellum, and abdomen, and the above description serves as a much more complete one.

This fly is not a very uncommon as of Japanese species I have records from Tokio, Iyo, Nagasaki, and Oita, from June 4th to July 10th, but my records do not extend north of Honshu. I caught two females which were biting the belly of a horse, hitched to the fence of a farmer's house near the city of Nagoya, on the first of July, but I have no other knowledge of its habits.

26. **Tabanus trigonus**, Coquillett. (Pl. VIII, fig. 2; Pl. XI, figs. 9 & 10).

(Ushi-Abu).

Proc. U. S. Nat. Mus., XXI, p. 309, 1898.

Ricardo, Ann. Mag. Nat. Hist., (7), XVI, p. 202, 1905; Rec. Ind. Mus. IV, p. 245, 1911.

Matsumura, Thous. Ins. Japan, II. p. 73, pl. XXII, fig. 5, 1905, 大日本害蟲全書, 後編, p. 71, pl. X, fig. 12, 1914.

Kertesz, Cat. Dipt., III, p. 278, 1908.

臨時馬疫調査會委員研究成績 (馬政局) 第二稿, Pl. V, fig. 2, 1914.

A very large fly, with the abdomen blackish or in the male reddish brown, being in bulk only slightly inferior to *T. chrysurus*, which is the bulkiest Japanese fly.

Female. Head slightly narrower than or as wide as the thorax, moderately arched behind. Frontal stripe greyish yellow, narrow and slightly contracted below, wholly seven times as long as its narrowest part or about five times as long as its broadest part; frontal callus

rather small, shining reddish brown or shining blackish and rather small and long, rifle bullet shaped, blunted below, not extended outwards to the eyes but extending upwards in a narrow line to beyond the middle of the frontal stripe, the extension almost always being about two and a half times as long as the callus proper; pubescence very short mostly depressed and rather inconspicuous, black, intermixed with minute yellowish hairs all over the surface except about the vertex, and without any trace of longer hairs about the vertex; frontal triangle pale castaneous but quite obscured by a whitish dust, and quite bare, the median sulcus very fine and inconspicuous, the double lunules just above the antennal sockets fresh yellowish. Face and jowls greyish yellow, but the mostly part of the epistoma, and jowls conspicuously paler, clothed on the cheeks with fairly dense but not long yellow pubescence and about the upper lateral corners of the epistoma with somewhat long conspicuous black hairs, the rest of the epistoma nearly bare but about the upper two-thirds of the middle with some short sloping inconspicuous yellowish hairs; jowls covered with numerous dense longer yellow pubescence which extends a little up to the back of the head; back of the head hollowed out but with a narrow equal bare rim against the eyes which is yellowish grey and behind which is an obvious though short black ciliation of dense bristly hairs, but this ciliation is interrupted at the vertex where there are some shorter black hairs; absolute back of the head with soft scattered yellowish white pubescence; ocellar tubercle absent, but its place on the vertex more or less darkened. Proboscis rather stout and long, about two-thirds as long as the depth of the head, dark brown; the stalk covered with greyish yellow or pale reddish yellow tomentum and with yellowish brown pubescence behind, but at the side there are shorter brown rather bristly hairs; sucker-flaps much longer than the stalk, covered with short erect mixed brown and yellowish brown bristly hairs on the underside. Palpi with the second joint elongate pale yellow or orange yellow or brownish yellow,

abruptly bent after its base and thickest at the bend, after which the joint only gradually tapers to a round tip, almost four times as long as its broadest part and bearing dense black short depressed bristles all over the outside, not varying in thickness of the bristles down to the lower margin, but a very few minute inconspicuous pubescence exists there near the base or sometimes near the top, practically no longer yellow hairs beneath about the base; basal joint more reddish or brownish, or sometimes darker, about one-thirds as long as the end-joint and narrower, clothed with abundant long yellow pubescence which becomes a little shorter towards the top where there are some shorter but conspicuous black hairs at the outside. Antennae yellowish brown, with the basal annulation usually orange yellow, and with the style-like portion almost always blackish brown; the basal joint somewhat obscured by grey dust, slightly thickened towards the top where it is somewhat hooked over the base of the second joint above, about one and a half times as long as its broadest part, bearing dense short black bristles almost all over the surface but on the underside almost bare except about the tip where a few somewhat longer black bristles exist; second joint small and hardly a half the length of the first joint, with the top above prolonged over the base of the third joint and also clothed with short black bristles, the prolongation being very narrow somewhat spine-like, about as long as or slightly shorter than this joint; third joint strongly humped dorsally a little before the middle and then excavated at a rather narrow angle as the tooth is directed forwards, its basal annulation slightly longer than its depth at the hump and with a few tiny black bristles on the top of its dorsal hump and about the middle of its underside which is distinctly but bluntly angulated beneath; style-like portion pointed at the tip, about two-thirds as long as the basal annulation of the third joint, the annulation gradually lengthend, but the basal three wider than their length, while the apical one is conical and is about twice as long as the basal one, each annulation bearing two or three

very fine pubescence which is more conspicuous than that of the other species. Eyes in death unicolorous, deep purplish black with some green shimmer in some light; when seen from above the frontal margin shorter than the hind margin which is straight, and the outer margin moderately curved outwards especially at the posterior half, the top angle about 100°, the frontal angle about 75°, and the outer angle rounded and about 70°, in profile irregularily ovate and slightly deeper than long, the frontal margin more curved than the posterior margin but a little shorter, and the lower margin strongly convex, the top angle about 80° and roundish, the frontal and lower angles almost always nearly evenly rounded; when seen from front the facial margin hardly straight and wholly three-fourth as long as the frontal margin, and the outer margin almost evenly rounded strongly, the frontal angle about 135°, the top angle about 95°, and the lower angle roundish and about 120°

Thorax large, very slightly longer than wide, blackish, slightly obscured by a greyish tomentum, with five rather broad yellowish grey tomentose stripes of which the middle one is narrowest and does not reach the posterior margin but extending just after the suture, the next pair most conspicuous, and almost equal in width through the whole length, and very slightly contracting behind, while the lateral pair is most inconspicuous (though they are broadest) and extends from the humeri to the upper bases of the wings, these lateral stripes being united with the outer middle pair at their apical extremities; pubescence on the disc abundant, short, suberect, black, on the stripes and about the suture intermixed with rather numerous more depressed yellowish hairs which can only seen from the front and can be easily rubbed out when the specimens are ill-treated, and on the apical vertical part there are numerous fine though longer pale hairs; humeri conspicuously yellowish, covered with a greyish tomentum and with long fine pale yellowish grey pubescence, and the posterior border bearing a few stout conspicuous black hairs which are posteriorily

directed; praealar calli covered with abundant short though stout black hairs which are irregularily curved and are intermixed with some short yellow hairs about the upper half, and about the lower margin there are dense long erect conspicuous black bristly hairs which extend to the triangular space between the humeri and this calli; postalar calli usually reddish brown, obscured by a greyish tomentum and covered with short black pubescence, and on the outer margin there is a long conspicuous pale yellowish grey tuft, the similar but shorter tuft about the upper base of the wing, where the surface is very often dull reddish yellow or greyish yellow. Scutellum triangular with the posterior angle roundish, blackish, obscured by greyish or pale yellowish grey tomentum, and clothed with abundant short black pubescence which is intermixed with some short inconspicuous yellowish hairs around the margin. Pleurae covered with yellowish grey or pale yellowish grey tomentum and with abundant long light yellowish or white yellow pubescence which becomes denser and slightly longer above and is intermixed with sparse or dense black hairs on the mesopleurae especially about the posterior half, and on the prothorax there are much longer denser yellowish hairs, and on the upper posterior margins of the meso- and ptero-pleurae and on the upper margin of the metapleurae, there are dense yellowish grey tufts.

Wings with a brownish yellow tinge, especially towards the costa, and with the veins brown but slightly yellowish towards the base; posterior cells all widely open but first one more or less narrowed at the margin, discal cell very large and apparently longer than the second posterior cell, and anal cell narrow and closed with a rather long petiole; upper branch of the cubital fork with a somewhat long recurrent veinlet, and the stigma yellowish brown. Squamae in the alar pair grey with a dark brown margin and with a comparatively long and dense greyish yellow fringe excepting of a long whitish yellow tuft about the angle; in the thoracal pair paly yellowish brown with a brownish margin and with shorter inconspicuous pale fringe.

Halteres comparatively small, blackish brown, with the stem and the top of the knob yellow to brownish orange.

Legs blackish or brown, with the tibiae dull light yellow or yellowish; fore coxae moderately dilated, about two-thirds as long as the fore femora, dusted with yellowish grey or pale yellowish grey, and clothed with a rather dense long paler yellow pubescence which is gradually shortened towards the top and has some shimmer in a certain light; fore femora almost always blackish brown with the apex pale reddish yellow or dull yellowish, covered with some greyish tomentum left the broad shining blackish castaneous subfemoral bare space which is hollowed out almost throughout and is finely transversely striolate, on the inner margin of this bare space there are very numerous short conspicuous black bristles in a row, the outside clothed with dense long dull yellow pubescence which is intermixed with some black hairs especially about the upper part, and the rest covered with dense depressed black pubescence which on the apical part rarely has reddish yellow tip; two pairs of the posterior tibiae paler than the front pair, blackish about the bases and gradually palened apically to dull yellow or pale reddish yellow, clothed with very numerous yellow pubescence which becomes longer on the outer and lower sides of the middle femora, as well as the underside and about of the upper side of the hind femora, and which on the innerside of the middle femora is replaced by shorter black hairs and on the same side of the last pair is very sparse and becomes shorter; front tibiae not dilated, straight, pale yellowish or pale reddish yellow, darkened about the tips or very often slightly brownish throughout the underside, covered with dense depressed tiny yellow pubescence which on the narrow brownish underside becomes dark brown and on the rest is intermixed with very few inconspicuous black hairs; middle tibiae about the tip hardly darkened, covered with very short rather depressed yellow pubescence intermixed with some very scattered black hairs all over the surface especially about the tip, and bearing two unequal com-

paratively short black spurs with reddish base; hind tibiae very slightly brownish about the apical thirds, covered with short dense yellowish pubescence and with somewhat longe outer- and inner-upper and inner-lower fringes of mixed yellowish and black hairs; tarsi blackish, with short dense black pubescence which becomes reddish on the underside, bearing black claws and dull yellow pulvilli.

Abdomen conspicuously flat, much broader than the thorax but gradually narrowed to the roundish anal apex, and apparently longer than the head and thorax (including the scutellum) together. Dorsum black or blackish, with two large semicircular unwell-defined reddish brown markings on the second segment or the second and third or the second to the fourth segments, with a rather broad black median stripe which is interrupted at the segmentations and is narrowed towards the anterior margin of each segment, this stripe being only conspicuous on the segments which have reddish markings, and somewhat well-defined in the paler specimens; on each segment with the narrow pale brownish yellow or yellowish band which is somewhat broadened at the sides, and with grey tomentose median triangle except on the first and seventh segments, the triangles being large and extending up to the anterior margin of each segment; pubescence dense, depressed, and blackish, but on the bands, middle triangles, and sides yellow or light yellow, on the first segment there are rather numerous yellow hairs on just outside of the margin of the scutellum. Ventre reddish brown or yellowish red with the broad or narrow lateral parts and the last two or three segments blackish and very often the second segment darkened above the posterior half except on the posterior margin of each segment; pubescence yellow or light yellow but that on about the middle thirds or more blackish, which causes slight darker appearance of the broad middle part of each segment, and on the seventh segment bearing abundant longer erect and slightly curved black bristly hairs.

Length: 22-26 mm.

Male. Usually more yellowish and much slender than the female. Head as long as or a little narrower than the thorax, but much more arched. Frontal triangle flat, whitish grey with the upper angle yellowish brown and prolonged narrowly a very short distance between the eyes; face and jowls usually more yellowish than the female, the epistoma deeply sunken and nearly bare from pubescence, while the cheeks are conspicuously inflated and covered with moderately long and dense brownish yellow or deep yellow pubescence which grows conspicuously longer on the jowls; back of the head rather shallow on the lower part and hollowed out behind the eyes on the upper part, ashy grey with some yellowish tinge, and bearing some scattered fine yellowish white pubescence which extends a little below to the jowls where it becomes very longer; postocular rim very narrow and its temple region not seen from above, behind which is a short black ciliation which is conspicuous only about the angle just before the vertex; vertex very small and tubercular, dark brown, bearing some short black pubescence on the hind margin. Proboscis rather slender, about two-thirds as long as the depth of the head, blackish brown; the stalk covered with pale yellow pubescence behind and with some shorter inconspicuous darker hairs on the sides; the sucker-flaps furnished with short scattered yellowish brown bristly hairs. Palpi much more smaller than those in the female, dull orange; basal joint narrower than the end joint and about half as long as that, dusted with greyish on the outside and clothed with moderately long brownish yellow or deep yellow pubescence; the second joint about two and a half times as long as the breadth of its middle part, with a bluntly angulated end, bearing numerous depressed black bristles on the outside with a very few yellow ones intermixed usually, and with numerous long conspicuous yellowish hairs on the upper margin and with sparser shorter yellowish grey hairs inside and beneath. Antenae usually dark yellowish brown with the broadened portion of the third joint conspicuously pale orange yellow; the basal joint short but longer

than its broadest part, with the apex slightly hooked over the base of the second joint, and bearing dense short black bristles all over the surface except on the underside there are thinner (but almost equally short) yellowish hairs; second joint about one-thirds as long as the first joint, with a long spine-like process above the tip, and with a complete of short rather dense black bristles; third joint much narrower than in the female, with a long tooth about the basal half, and with the ventral margin very slightly bluntly angulated below, this curvature and the dorsal tooth furnished with some short but conspicuous black bristles, and the similar but very fine inconspicuous ones near the base of the outside; style-like portion shorter than the basal annulation of the third joint, brown with the apical annulation blackish, the three basal annulations about the same in both the length and width, while the apical one is longer and is pointed apically, each annulation bearing one or two or sometimes there minute pubescence about the tip. Eyes large, bare, and in death yellowish brown in the small facets and deep purplish black in the large facets; facets nearly on the upper three-fourth very much enlarged, and the large facets extend upwards to the hind margin passing the ocellar tubercle and downwards to and rather beyond the junction of the eyes, while the small facets do not extend in a zone up along the back margin through the contrast in size is not so conspicuous there, the dividing line across the eyes is very undulating and the posterior end reaching over the middle of the hind margin of the eye; when seen from above the frontal margin as long as the posterior margin which is very slightly concave, and the outer margin evenly convex, the top angle about 90° and very inconspicuously rounded, and the frontal angle about 70° and somewhat roundish; in profile deeper than the length, frontal margin nearly straight but the upper part slightly convex, the posterior margin longest and moderately curved outwards, and the lower margin shortest and convex, the frontal angle largely rounded and about 95°, the lower angle roundish, and the top angle about 80°; when seen

from front deeper than the width, the facial margin very slightly convex and a little shorter than the frontal margin, and the outer margin strongly and about evenly convex, the facial angle about 140°, the lower angle about 100° and slightly rounded, and the top angle hardly 90°.

Thorax somewhat paler than in the female, with the blackish pubescence longer and with the yellowish one more abundant and longer, the pubescence on the pleurae also longer and much more conspicuous; scutellum usually bearing a rather conspicuous yellowish hairs round the margin.

Wings, squamae, and halteres almost as in the female, but the upper branch of the cubital fork of the wings very often without any recurrent veinlet.

Legs as in the female, but the all fringes more conspicuous and intermixed with more black hairs.

Abdomen rather slender, less flat than in the female, and more yellowish, broader than the thorax about the base and gradually narrowed towards the apex where it is always pointed so that the abdomen is somewhat regularily conical. Dorsum with the large yellowish lateral spots which occupy most of the basal four segments except on the fairly broad blackish median spots which are gradually broadened on the posterior segments and on which there are grey tomentose triangles, the three apical segments black, and with the hind margins of all the dorsal segments yellowish orange, the colour extending to the sides, and on the inside of the yellow lateral margins there is very irregular small inconspicuous dark spot on the second, third and fourth segments, in which the posterior one is usually connected with the median spot behind; the first segment sometimes wholly blackish excepting of the narrow pale orange yellow posterior band; pubescence black but yellowish on the median yellowish triangles, orange yellow posterior bands and the sides. Ventre paler than the dorsum with the posterior segments blackish, covered with the yellowish

pubescence but on the middle part of each segment and on mostly part of the fourth and fifth segments with black one, the seventh segment clothed with dense longer black bristly hairs especially about the middle.

Length: 23-25 mm.

This species is closely allied to *Tabanus yao*, Macquart, but distinguished from it in the female, by the blackish femora, tarsi and abdomen, by the black pubescence on the frontal stripe, and by many other minor points. Although it may be a Japanese subform of *T. yao* as pointed out by Miss Ricardo, the name *trigonus* may remain safely as a specific one until many of the specimens of *yao* are carefully studied.

T. trigonus varies but very little in the colour of the abdomen and of the legs, as well as in the amount of the blackish pubescence as already described above.

This large fly is rather common in Japan, but the occurence is quite restricted to the main Island of Japan, Shikoku, and Kiushu, while in Hokkaido and others it does not occur, as I have records only from Akita, Tokio, Hakone, Tateyama, Izu, Gifu, Matsuyama, Kioto, Kumamoto, Oita, Hitoyoshi, Miyazaki, and Oshima (Izu), from June 12th, to September 9th.

The females are well known cattle or horse biters, and they sometimes pierce through the skin of the back of our body with their large proboscis. Their bites are rather painful, and the effects almost always last three or four days. The female flies are most abundant in August throughout the countries where they occur, especially from about 2 to 7 o'clock in the afternoon. It is believed by many of our verterinary surgeon that this species may be a good transmitter of a certain infectious anoemia of horses. The males are rather uncommon, but we could take some specimens with care among bushes, and they sometimes dence in hot sunshine between eleven and twelve o'clock, in groups of, from two to four individuals above various bushes.

27. **Tabanus exoticus**, Ricardo, (Pl. VIII, fig. 3).

(Taiwan-Ushi-Abu).

Ann. Nat.-Hist. Mus. Nat. Hung., XI. p. 170, 1913; Suppl. Entom., III, p. 64, 1914.

Tabanus trigonus, Shiraki, Tokubetsu-Hokoku, Agr. Exp. Stat., Governm. Formosa, VIII, p. 200, 1913.

A large blackish brown or reddish brown or sometimes reddish yellow species, with rather narrow frontal stripe in which is a narrow oblong blackish callus with a very long rather fine extension, with greyish yellow median triangles and narrow bands on the abdomen, with blackish or brownish legs, and with brownish wings.

Female. Head very slightly broader than the thorax and shorter than its half, moderately arched. Frontal stripe greyish yellow to brownish yellow, narrow, gradually contracted from the vertex to the lower end, wholly eight to eleven times as long as its narrowest part or about five to seven times as long as its broadest part, bearing rather abundant short but stout black pubescence which is mostly sloping and extends more than the upper two-thirds, and which is intermixed with some inconspicuous yellowish hairs about the middle of the frontal stripe, the yellowish hairs extending below to or beyond the frontal callus; frontal callus blackish, oblong, narrow, moderately convex, not reaching the eyes; with a linear extension which is about one and a half times as long as the callus; vertex less yellowish than the fore head, usually dusted with ashy grey tomentum and covered with short black pubescence which extends behind but not overhanging there though it is a little longer; frontal triangle little convex, with a very fine very inconspicuous median stripe which only extends up about the middle, covered with thick greyish yellow tomentum in blackish species or thick silvery white in reddish and yellowish ones, but the double lunules just above the antennal sockets always covered

with a yellowish dust. Face covered with greyish yellow tomentum which becomes paler on the most part of the epistoma, and which is always darker towards the upper part of the cheeks and epistoma especially on the former; pubescence on the epistoma short sparse whitish, intermixed with some stout long black hairs about the upper corners where there are somewhat longer fine brownish hairs, and about the middle there is a very few short inconspicuous blackish pubescence; pubescence on the cheeks longer and much conspicuous, yellowish white or yellowish grey, gradually palened towards the jowls especially about the lateral pits of the epistoma, about the upper end there are some shorter brownish or very rarely blackish hairs which extend below to about the middle along the eye-margins; pubescence on the jowls and behind the mouth conspicuously longer and denser, somewhat shaggy, in general yellow but sometimes yellowish brown, which extends up to the back of the head at where it becomes paler and less longer; back of the head moderately hollowed out about the upper half, dusted with yellowish grey and sparsely covered with some fine rather long pale yellowish pubescence, with a narrow pale yellowish grey tomentose bare postocular rim which is rather suddenly and conspicuously widened just before the top corners of the eyes and before that is slightly narrower than the most part where it is about as much as one-seventh the width of the vertex, immediately behind this postocular rim a comparatively long black ciliation of stout overhanging bristly hairs exists which extends below to the jowls. Proboscis rather long and stout, about two-thirds as long as the depth of the head, blackish, slightly obscured by greyish brown tomentum; the stalk rather short, covered with greyish or yellowish grey dust and some long erect yellowish or black bristly hairs behind, at the sides there are usually some shorter black bristly hairs which are never yellowish; sucker-flaps large, longer than the stalk, darker, furnished with a few scattered short and erect yellowish brown or yellow pubescence. Palpi reddish yellow or pale dull yellow, slender

and long; the first joint short and about three-tenths as long as the second joint, covered with long but shorter than that below the mouth part yellow pubescence which is sometimes intermixed with some scattered black hairs on the underside, and about the outer apex there is almost always a few short inconspicuous black pubescence; second joint almost the same width throughout but gradually narrowed to an apical blunt point, clothed with numerous short depressed black bristles all over the surface except about the basal two-thirds of the inner side. Antennae dull reddish brown, with the broadened basal annulation of the third joint deep orange yellow or sometimes dull reddish brown or very rarely blackish brown; first joint sometimes reddish yellow, rather narrow, one and a half times as long as its thickest apical part, slightly drawn out cap-like over the second joint, and with numerous short black bristly hairs all over the surface except the narrow underside bare but bearing some longer black hairs at its apex; second joint small and about one-third as long as the basal joint, with a conspicuous apical dorsal process which is usually shorter than or sometimes much longer or about twice as long as this joint, with a complete circlet of short black bristly hairs at the tip; third joint very much broadened at the basal annulation, about two and two-fifths times as long as its thickest part where it has a large but short tooth crowned with some short black bristles at the dorsal margin and is bluntly roundly slightly angulated at the ventral margin, this lower angle bearing a very few (usually two or three but conspicuous) minute black baistles; style-like portion blackish or sometimes slightly darker than the rest of the third joint, about two thirds as long as the basal annulation of the third joint, the basal three annulations gradually lengthened apically or about the same, the top annulation somewhat long conical with a blunt point, and about twice as long as the basal one, bearing one or two or three fine inconspicuous pubescence on each annulation. Eyes in death deep purplish black, with some greenish shimmer in some lights, and with the facets all equal in

size; when seen from above the frontal margin about two-thirds as long as the hind margin which is hardly concave, the outer margin longest and strongly convex, the top angle about 100°, the front angle about 65°, and the outer angle roundish and about 70°; in profile elongate oval, about two-thirds as long as its depth, the frontal margin slightly convex, the remaining margins rather strongly curved outwards, the top angle about 80° and slightly roundish; when seen from in front about as wide as its depth, the facial margin slightly convex and about two-thirds as long as the frontal margin which is not quite straight but inconspicuously convex near the top, the frontal angle more than 135°, and the lower angle about 120° and conspicuously rounded.

Thorax rather large, longer than wide, brownish, with greyish or yellowish grey tomentum which is conspicuously dense at the apical part, and with five inconspicuous greyish or yellowish grey stripes which extend from the apical margin to the posterior margin excepting on the very narrow middle one only at the apical half, and of which the middle three stripes are usually yellowish, while the broad lateral pair is greyer than the rest ones and is interrupted at the suture, and behind that they are more inconspicuous, reaching only to the apical end of the postalar calli; pubescence on the disc numerous, short, suberect, black, intermixed with a few short fulvous hairs especially about the suture and on the stripes excepting of the narrow median one; humeri rather conspicuous, covered with some stout sloping black bristly hairs about the upper half and with fine but longer yellowish hairs on the rest; praealar calli somewhat pinckish, clothed with stout erect black bristly hairs which grow longer below to the lower margin and become distinctly shorter though they are somewhat shaggy about the upper half, where there are some short golden yellow or yellowish hairs intermixed, the long black hairs extending on the intervals between the humeri and praealar calli and becoming thinner though longer there; postalar calli usually paler

than the disc, covered with short black pubescence similar to that on the disc, and bearing a tuft of numerous long yellowish hairs about the apical half of the outer margin, the similar tuft (though shorter) just above the base of the wing. Scutellum more densely covered with greyish or yellowish grey tomentum, clothed with black pubescence intermixed with a few short inconspicuous yellow or golden yellow hairs which become conspicuously dense and rather longer around the margin and extend up to about the posterior half of the outer margin of postalar calli. Pleurae densely clothed with greyish or pale yellowish grey tomentum, and covered with numerous rather short yellowish grey tomentum, and covered with numerous rather short yellowish white pubescence which becomes longer on the mesopleurae where there are some shorter black hairs intermixed about the posterior thirds; prothorax clothed with abundant longer tuft yellowish white pubescence; tufts at the postero-upper margins of the meso- and meta-pleurae, and at the upper margin of the pteropleurae very long, shaggy, yellowish white.

Wings yellowish brown or pale brown, but usually paler about the middle of almost all the cells, with the veins brown, and with the stigma yellowish; costal cell conspicuously yellowish, the marginal cell with a long nearly quite clear spot all over the base; posterior cells widely open, but the first one often a little narrowed at the border, anal cell closed with a long petiole, and the discal cell large and much longer than the second posterior cell; the upper branch of the cubital fork with a distinct recurrent veinlet. Squamae in the alar pair grey or greyish brown with a brown margin and with a dense short conspicuous yellowish brown fringe excepting of the long yellow tuft about the angle, in the thoracal pair yellowish brown or dull yellowish orange with a brown or browish yellow or rarely dull orange margin and with a brownish or yellowish or dull orange fringe. Halteres dull brown or blackish brown with the top of the knob greyish yellow or greyish white, or rarely with the stalk yellowish brown or reddish brown.

Legs blackish, with the tibiae dark brown or brownish; fore coxae densely covered with greyish yellow tomentum, and clothed with long yellowish pubescence which becomes short towards the apex and is intermixed with some black hairs about the apical two-thirds of the outer side; fore femora black, inconspicuously covered with greyish tomentum except the broad transversely striolate subfemoral bare space which is hollowed out about the apical half, inner margin of the bare space bearing a short conspicuous black ciliation, pubescence numerous and black on the outer half, long and erect, but on the rest shorter and depressed, on the outside there are some long yellow or golden yellow hairs intermixed; posterior two pairs of femora black or sometimes reddish brown at the tip, dusted with grey especially on the underside, covered with dense short suberect black pubescence which is intermixed with yellow or golden yellow hairs about the base of the upper side or sometimes along the upper side or rarely all over the surface, on the outer-lower margin of the middle femora with the long yellow or golden yellow fringe which is usually intermixed with a very few black pubescence, and on the lower margin of the hind femora with similar but less long fringe, while about the base of the upper margin of the hind femora there is a long yellow or golden yellow fringe intermixed with some long black hairs; fore tibiae usually blackish brown but sometimes browner reddish brown, darker towards the apex, not dilated but slightly curved, clothed with dense short black pubescence which on the underside may be seen as a reddish brown one in a certain light; the colour of posterior two pairs of the tibiae as in the fore pair, but the pubescence longer, black, and in the redder specimens intermixed with very few yellow or golden yellow hairs about the base, especially on the underside, or sometimes all over the surface except about the apical thirds or fourths; hind tibiae bearing a long (still short) somewhat conspicuous black fringe on each of the outer-upper and inner-lower margins, and middle tibiae with two short unequal black spurs which are sometimes

brown or reddish brown about the base; tarsi black or blackish brown, covered with numerous short depressed black pubescence which is golden yellow or reddish yellow on the underside when seen from a certain direction, bearing deep orange yellow pulvilli and black claws with the base yellowish brown.

Abdomen broader than the thorax, gradually but very slightly narrowed to a large rounded anal margin, and gradually flattened behind. Dorsum blackish brown or reddish brown or yellowish brown, with a yellowish grey or reddish yellow tomentose median triangles on the segments excepting of the seventh segment, each spot clothed more or less with short depressed yellow or reddish yellow hairs and not reached the anterior margin, the posterior borders of the segments yellowish grey or reddish yellow dusted, widest at the sides, with yellow or reddish yellow hairs, most numerous at the sides; in the reddish or yellowish specimens the last three or four (in partly) segments blackish, and the first three or four segments with a black median spot about the anterior half of each segment; the yellowish bands gradually narrowed on the hinder segments so that the band on the seventh segment hardly exists; the median triangles on the first and sixth segments hardly recognisable, especially on the latter very often without any yellowish hairs; the sides of the first segment broadly greyish tomentose and covered with yellow or reddish yellow pubescence, of the first three segments behind that yellowish brown or in the redder or yellower specimens reddish yellow with yellow or reddish yellow pubescence, and of the last three segments blackish with black pubescence, except on the posterior margin of the fifth segment yellow or reddish yellow and bearing similar coloured pubescence; pubescence on the rest black. Ventre the same as on the dorsum, but paler in colour, no median spots, and the bands narrower and not well-defined; the pubescence as on the dorsum, but much shorter and the yellowish one more extending anteriorly; the seventh segment bearing numerous stout, curved, black bristly hairs about the

middle, as in the other *Tabanus*.

Length: 20-25 mm.

Male. Very much like the female, but the abdomen usually reddish brown.

Head somewhat large, not apparently broader than or sometimes as wide as the thorax, and longer than its half, arched. Frontal triangle pale greyish yellow or white, so conspicuously darkened at the top part as there is a blackish brown band, sometimes very slightly concave about the middle, the median fine sulcus very short and only existing on the lower third or half, and with two or three irregular oblique depressions each on side of the median line. Face pale greyish yellow or orange yellow; epistoma somewhat triangular, deeply sunk from the cheeks, with a large triangular depression in the middle, and bearing no pubescence; cheeks nearly the same in width throughout, inflated but not apparently raised from the eye-margins, much yellowish at the upper top and along the eye-margins, covered with numerous moderately long soft brownish or yellowish brown pubescence which is sometimes intermixed with some scattered inconspicuous black hairs about the upper half near the eye-margin, and which extends below to the jowls, at where it becomes longer somewhat shaggy, and paler; back of the head paler than the face, shallow on the lower part but hollowed out on the upper part, bearing some scattered whitish pubescence, but the longish pubescence behind the extreme lower part similar to that on the jowls; the postocular bare rim very narrow, gradually but slightly widened below to the jowls, not seen from above, behind which is a single ciliation of short black bristly hairs; vertex very small, yellowish brown or brown and bearing a few short blackish postvertical pubescence which is usually shorter than that of the postocular ciliation. Proboscis small, blackish; stalk shorter than the sucker-flaps, clothed with dense black or mixed brownish and black hairs behind; the sucker-flaps stouter, furnished with mixed black and yellowish brown bristly hairs beneath. Palpi reddish yellow, dull ye low-

ish or orange yellow; basal joint small, and narrow, shorter than the half of the end joint, usually darker, covered with numerous long pale yellowish brown or reddish brown pubescence intermixed with some conspicuous black hairs; second joint elongate ovate, about one-third as wide as its length, with a rather pointed tip about the lower end and below that there is an inconspicuous depression at the inner side, the inside nearly bare but the outer side with numerous rather long black pubescence which becomes considerably shorter about the tip. Antennae almost as in the female, but the basal joint more thickened and the tip nearly as wide as the broadest part of the third joint which has less out-curved lower margin of the basal annulation. Eyes bare, and in death deep purplish black or reddish, or yellowish, with various shimmer; facets enlarged on all the central portion of the combined eyes and in dead specimens yellowish or reddish or deep reddish purple there, while the smaller facets appear blackish and occupy nearly the lower half of the eyes and extend in a broad band up the back margin quite to the vertex, so that the small facets occupy considerably the major portion of the eyes; in only three specimens from the southern part of Formosa the large facets occupying quite two thirds of the surface, as in the description of Ricardo, or in a single specimen from Hozan more than two-thirds; the comparison between the large and small facets may be not valid character, but an indistinct dividing line (that is the facets gradually grow up larger towards the centre) between large and small facets is rather accessible character among many of specimens.

Thorax shorter than in the female, usually roundish, much more indistinctly striped; pubescence longer and apparently much slender, but the pale hairs less obvious, and on the upper base of the wings and at the outer margin of the postalar calli there is brownish tuft instead of yellowish one, and the numerous short yellow fringe on the margin of the greyer scutellum not existing.

Wings and halteres as in the female but the former with the recurrent veinlet of the upper branch of the cubital fork not always

present. Thoracal squamae usually darker.

Legs as in the female, but all the fringes slightly longer and more conspicuous with less paler hairs, or rarely in only the upper-outer one of the hind tibiae with somewhat numerous yellowish brown hairs intermixed.

Abdomen long conical, with the second segment usually broadest, and with the pointed anal apex. slightly longer than the head and thorax (including the scutellum) together. Dorsum reddish brown or rarely dark brown, with the last three segments blackish, the median triangles and narrow bands more yellowish (or yellowish red) than grey, while the blackish longitudinal spots just above the triangles always exist and rather well-defined; pubescence except on the triangles and bands longer and blackish, and at the sides there is no yellowish hairs. Ventre as in the female but usually more browner than the redder species of the female, caused by only the blackish pubescence except at the narrow yellowish posterior margins of the first four segments; pubescence more conspicuous than that in the female, and on the seventh segment there are more numerous much longer erect black bristly hairs.

Length: 19-23 mm.

This species apparently varies considerably in the colour of the abdomen both dorsally and ventrally, as some specimens are much more blackish (nearly black) or yellowish, but there is little variation in the males I have examined; the frontal triangle varies from pale greyish yellow to silvery white; the antennae are always mainly reddish, but the basal joints are often darkened, and the third joint is sometimes quite darkened all over; the amount of pale pubescence on legs, varies a little in the male, and very much in the female; the yellowish pubescence on the stalk of the proboscis is rarely quite absent in the female. One female specimen, from Hokuzanko in the district of Nanto, has five distinct dorsal stripes on the thorax, and bears an orange yellow postocular ciliation intermixed with a very few

black bristly hairs. This is probably an extremely perfect and rather young fly. The male specimens in my collection may be divided into two groups, of which the first one is rather redder and consists of the species which has a rather large space of the eyes occupied by the large facets, while the other contains the darker species which has a comparatively small area of large facets of eyes; the female specimens are also divided into two, the species belonging to the first group redder, and other blackish. It is, however, doubtful that this species may be separated into two distinct ones, with only our present knowledge.

T. exoticus is not uncommon but rather familiar to our students, and I have records from Taihoku, Shinten, Toyen, Hoppo, Karapai, Hokuzanko, Horisha, Giochi, Takao, Kosempo, Arikan, Koshun, Fuhosho, Kankau, Sokutsu, Kusukusu, and Choshu; I have no records from other countries. The dates extend from May 20th to August 20th, and it is curious that one of the eariest dates (May 20th) is from Taihoku, while the latest (August 20th) is from Koshun.

The females are almost found on the back or belly of Formosan cattle or sometimes buffaloes, free in pastures near villages or towns, from midday to just before sunset, from May to August, and they can sometimes be seen on a country road through wood or bushes, or near a stream; the males are caught by many collectors on a path between bushes, or in wood or bush, early in the morning or late in the evening; once I took a young male fly on a rock near a river-beach, about 9 o'clock in the morning, near Horisha. The bite of the females, although not painful, is very severe and draws blood more often than that of any other Formosan horse-fly.

T. exoticus has a resemblance to *Tabanus trigonus*, but is easily distinguished from it by its narrower body, by its quite interrupted median triangles of the brownish abdomen, by its darker legs, and by other minor points as described above. Formerly, I have ill-determined

the redder form of this species as *trigonus* by Coquillett's original description.

28. **Tabanus rufidens,** Bigot. (Pl. VII, figs. 7 & 8; Pl. XI, figs. 11 & 12).

(Yamato-Abu)

Atylotus rufidens, Bigot, Ann. Soc. Entom. France, (6), VII, Bull., p. LXXVIII, 1887.

Tabanus rufidens, Kertesz, Cat. Dipt., III, p. 275, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 245, 1911.

A medium-sized blackish species with the abdomen reddish yellow which is blackish at the apical part, with the long linear frontal callus on the narrow frontal stripe and with the blackish legs in which the tibiae are yellowish red or pale reddish brown, and with the small nearly equal sized facets of the male eyes.

Female. Head usually broader than the thorax, rather short. Frontal stripe pale yellowish grey or pale brownish yellow, slightly paler downwards, narrow, moderately contracting from the vertex to the lower end, and about five times as long as its broadest part or about six and a half times as long as its narrowest part; frontal callus shining black and rather long, blunted below, not extended to the eyes but extending upwards in a narrow line to beyond the middle of the frontal stripe, the proper callus being about a half as long as its upper linear extension; pubescence on the frontal stripe black but on the lower part there are some inconspicuous yellowish white or yellow hairs which usually very sparsely extend up to just below the vertex along the inside of the margins; vertex dark grey, covered with abundant short black pubescence which sometimes is intermixed with a few short inconspicuous yellow or yellowish white hairs about the middle, and behind the vertex there is an inconspicuous tuft of some very short (but slightly longer than those on the

vertex) black or black and yellow hairs. Frontal triangle slightly elevated, covered with a pale orange yellowish grey tomentum, with a fine median sulcus which is not extending up to the upper end, and with two or three or four irregular oblique very inconspicuous furrows on the upper lateral part, and there are no conspicuous lunules just above the antennal fossae. Face and jowls all pale greyish yellow, clothed on the cheeks with abundant very fine rather inconspicuous pale yellowish white pubescence; jowls with much longer yellowish pubescence which hardly extends up to the back of the head; epistoma moderately convex with the rather deep lateral pits, broader than twice the cheeks, nearly bare but on the upper lateral corners there are some short but conspicuous curved black hairs below which is a very few fine inconspicuous yellowish pubescence. Back of the head slightly hollowed out but with a narrow equal bare rim against the eyes which is yellowish grey and behind which is an obvious though short black ciliation and behind that is less conspicuous but longer yellowish ciliation, on the absolute back of the head there is some scattered very fine whitish soft pubescence. Proboscis blackish or brownish, rather long, about three-fourth as long as the depth of the head; stalk covered with pale brownish yellow pubescence behind; sucker-flaps rather stout, furnished with some fine conspicuous brown and yellowish bristly hairs. Palpi slender and dull orange yellow; first joint short, about one-thirds as long as the second joint, slightly dusted with dark grey on the outside, covered with numerous long yellow pubescence which becomes slightly shorter towards the apex where there is a few short black pubescence; second joint very long and narrow, abruptly bent soon after its base and thickest at the bend, after which the joint gradually tapers to a pointed tip, about four times as long as its broadest part, and bearing all black short depressed bristles on the outside, but there are some fine inconspicuous yellowish hairs about the base especially on the upper half and about the tip especially on the inside, while some longer yellowish hairs

occur beneath about the basal thirds. Antennae rather stout, pale orange yellow with the third joint reddish except the style-like portion blackish or brownish; first joint stout, slightly longer than wide, thickest at the tip when it is slightly hooked over the base of the second joint above, clothed with rather dense though short black bristles all over the surface except on the narrow underside which is almost bare but with a very few inconspicuous pale fine hairs and with three or four long black bristles at the tip; second joint very short and about one-thirds as long as the basal joint, sometimes slightly tinged with reddish, the apical upper prolongation rather long and about as long as the joint itself, the apical circlet of short black bristles complete; third joint with a large dorsal tooth just before the middle of the basal annulation, and with a very flat angle about the middle of its lower margin, about the top of the tooth and of the lower angle there are some minute black bristles, the similar but more inconspicuous bristles near the base of the outside; the basal annulation of the third joint very broad, and about one and a half times as long as its broadest part, usually darkened towards the apex; style-like portion apparently shorter than the basal annulation of the third joint, the basal three annulations usually rather transverse, of which the second annulation is shortest and the third is longest, the apical annulation elongated conical and about twice as long as the first one, each annulation bearing one or sometimes three inconspicuous pubescence near the tip. Eyes bare, but sometimes very inconspicuously pubescent, with the facets all equal, in death deep purplish black with some greenish shimmer; when seen from above the frontal margin about two-thirds as long as the hind margin which is almost always nearly straight, the outer margin slightly but evenly convex, the top angle about 100°, the frontal angle about 80°; in profile oval and the length about two-thirds as long as the depth, the frontal and posterior margins slightly almost evenly convex and the lower margin strongly curved below; when seen from in front the facial margin very slightly convex,

about three-fourth as long as the frontal margin, the outer margin very strongly curved outwards, the top angle about 90° and the frontal angle wholly 135°.

Thorax stout, broader than the length, somewhat quadrate, blackish or brownish obscured by a greyish yellow tomentum, with five indistinct yellowish grey stripes of which the middle one is very narrow, not reaching to the posterior margin, and second pair is much conspicuous, equal in width, and slightly oblique inwards but not touching each other, while the lateral pair is broadest but less distinct and interrupted at the suture after which they are suddenly narrowed, on the inside of the narrowed lateral stripes the disc is slightly reddish, the colour usually extending below to the postalar calli; pubescence on the disc black, which becomes somewhat paler on the front vertical part, and which is intermixed with rather numerous short depressed golden yellow or deep yellow hairs on the stripes and about the suture; humeri pale yellowish brown, dusted with ashy grey, and covered with rather long yellowish brown or yellowish grey hairs which are sometimes intermixed with a few short rather stout black pubescence on the upper half; praealar calli distinct and somewhat paler than the disc, covered with rather sparse black and yellow hairs but on the lower half there is a conspicuous black tuft of longer erect hairs which slightly extend on the interval between the humeri and the praealar calli; postalar calli clothed with rather sparse short black and golden yellow or deep yellow hairs, and the postero-outer margin furnished with a long conspicuous golden yellow or rich yellow tuft of slightly curved and somewhat shaggy hairs which becomes shorter behind, the similar but apparently shorter tuft on the upper base of the wing. Scutellum rather large, in the colour similar to the thorax, co ered with a grey or greyish tomentum and with numerous black pubescence, at the margin there are dense though short golden yellow or deep yellow hairs. Pleurae densely covered with a greyish yellow or grey tomentum, and bearing numerous long yellowish grey soft

pubescence which is intermixed with abundant similar but black hairs on the posterior-upper half of the mesopleurae ; prothorax clothed with not very much dense long yellowish grey hairs ; on the postero-upper margin of the meso- and meta-pleurae and on the upper margin of the pteropleurae there is a very long shaggy conspicuous golden yellow or deep yellow tuft.

Wings with a brownish yellow tinge, especially towards the costa ; veins brown but sometimes yellowish in part especially on the mediastinal, radial, and postical veins, stigma yellowish ; all the posterior cells widely open but the first one slightly narrowed at the margin ; anal cell closed with a moderately long petiole ; discal cell large, apparently longer than the second posterior cell ; upper branch of the cubital fork with a distinct recurrent veinlet rather near the base. Squamae in alar pair grey with a blackish brown margin which bears a conspicuous yellowish brown ciliation excepting of the long pale yellowish white tuft about the angle ; in the thoracal pair pale yellowish brown with a dark margin and with a brown ciliation of rather dense shorter hairs. Halteres dark brown, with the knob almost always yellowish white at the tip.

Legs blackish brown but dull yellowish brown on the extreme tips of the femora and on all the tibiae except on about the apical half of the front tibiae blackish ; front coxae moderately dilated and about three-fourth as long as the front femora, clothed with a dense grey tomentum and with numerous moderately long yellow hairs which is intermixed with a few shorter black pubescence near the tip ; front femora covered with a greyish tomentum leaving a rather broad shining dark castaneous subfemoral bare space which is slightly hollowed out and is transversely striolate, on the inside of this space there is a not very dense though comparatively long conspicuous black ciliation, the pubescence on the inside short depressed and black but on the outside long and yellowish brown or yellow forming a rather dense conspicuous outer fringe ; two posterior pairs of the femora slightly covered

with a greyish tomentum, and clothed with dense short black pubescense on the inner half and with dense longer pale yellowish brown or yellow one on the rest, but on the outside of the hind femora there are some short black hairs intermixed; front tibiae not dilated but slightly curved with numerous short depressed black pubescence; middle tibiae slightly darkened at the tip, clothed with somewhat less numerous depressed black pubescence which is intermixed with some short inconspicuous yellowish brown hairs on the underside, with two unequal rather stout blackish apical spurs; hind tibiae also darkened at the tip, bearing similar but a little longer pubescence which does not apparently form the fringes; tarsi all covered with numerous short depressed black bristles, and bearing the black claws and the dull yellowish brown pulvilli, the soles of the two posterior tibiae somewhat deep reddish yellow.

Abdomen flat, broader than the thorax but the apical two segments narrower, and apparently longer than the head and thorax (including the scutellum) together, with the rounded apex. Dorsum yellowish brown with the three apical segments blackish and with a yellowish band on the posterior margin of each segment, as well as with conspicuous median yellowish grey tomentose triangles; the yellowish segments with moderately broad interrupted median black stripe and with a small irregular shaped blackish spot on the side (not extreme margin) of each segment, which on the fourth segment is most conspicuous and on the first segment or sometimes on the first two segments is wanted; median black spot on the basal segment sometimes enlarged and extended towards the sides leaving only narrow posterior and lateral margins; pubescence on the disc numerous, short, depressed, and black, but on the median triangles, on the posterior band of each segment, aad on the first segment, yellow, and the sides covered with slightly yellow pubescence. Ventre similar to the dorsum but slightly paler and without any markings, but with narrow bands; pubescence on the first four segments mainly yellow but on about the

middle part (sometimes almost through the width) black; while the pubescence on the remaining segments is almost all black excepting of the posterior fring of each segment yellow; the seventh segment clothed with dense long black bristly hairs.

Length: 17-22 mm.

Male. Almost like the female. Head not conspicuously larger or more arched than in the female, though slightly broader than the thorax. Frontal triangle greyish yellow or pale greyish yellow, conspicuously darkened at the upper angle which is prolonged narrowly a short distinct between the eyes; the median sulcus fine, extending throughout the length of the frontal triangle but never reaching the top angle and just below which there are some rather deep oblique depression on each side of the median sulcus. Face greyish yellow or yellowish grey, bare on quite the middle but with long fairly dense and fine greyish yellow or deep yellow pubescence round the bare part of the epistoma and on the inflated cheeks and with much numerous, longer, more conspicuous black hairs on the cheeks, the black hairs in amount as some specimens bear only black hairs on the cheeks; pubescence on the lower part of the cheeks, at the back of the mouth and on the jowls longer and yellow or sometimes deep yellow, and sometimes on the lower part of the cheeks there is black pubescence intermixed. Back of the head moderately hollowed out and with a very narrow yellowish bare postocular rim which at the temple region is practically sunk behind the eyes, and behind which is a very short though rather conspicuous black ciliation which slightly grows longer near the top angle of the eyes and which has somewhat long overhanging or outstanding hairs; vertex very small, globular, dark grey and clothed with short inconspicuous black pubescence which is not nearly long enough to constitute a tuft; absolute back of the head pale yellowish grey or greyish yellow, bearing some scattered yellowish white soft hairs which become more yellowish and longer on the lower part just behind the jowls. Proboscis as in the female, but

apparently smaller and furnished with rather longer and more numerous hairs. Palpi very small, dull orange yellow or deep orange yellow; basal joint oblong, obscured by a dark grey tomentum and covered with abundant long yellowish pubescence which is intermixed with a very few short inconspicuous black hairs at the tip; second joint oblong ovate, bladdery, wholly one and a half times as long as the first joint and wholly twice as long as its thickest part which is a little before its middle, and ending in a rather sudden blunt conical or sometimes evenly rounded tip, and usually with a slight compression beneath just before the tip, widely clothed on its upper part with long yellow or sometimes black pubescence of which there is usually some indication on the underside, but the lower half of the outside, sometimes all the underside, and all the tip with numerous dense not very short black bristly hairs. Antennae usually paler than in the female, and with much narrower third joint; basal two joints exactly the same as those in the female; third joint rather slender, about twice as long as the basal joints together, with a large dorsal tooth before the middle of the basal annulation which is very slightly bent downwards about the middle of the under margin, dorsal hump and the ventral bend both crowned with some minute but conspicuous black bristles which usually extend near the base of the outside of the basal annulation; style-like portion of the third joint as in the female, but bearing more conspicuous fine pubescence. Eyes very inconspicuously and sparsely pubescent, but practically bare, with the facets all very small and practically equal, in death deep purplish black, with an obvious greenish shimmer in any lights; when seen from above the frontal margin about two-thirds as long as the hind margin which is hardly concave, and the outer margin moderately curved outwards, the top angle more than 90°, the frontal angle wholly 65° and the outer angle roundish and about 75°; in profile somewhat triangle, about two-thirds as long as its depth, the frontal and hind margins both very slightly convex and the lower margin strongly curved below, the top angle about 50°,

the frontal and hind angles with similarily rounded; when seen from front slightly deeper than the width, the facial margin nearly straight and about as long as the frontal margin, the frontal angle wholly 135°, the top angle about 90° and the lower angle about 110°.

Thorax comparatively large, roundish, greyer than in the female, and with longer erect blackish pubescence and less yellow depressed hairs, which cause the yellowish grey stripes to become less obvious; pubescence on the pleurae more abundant and much longer. Scutellum greyer, with the erect blackish pubescence much long, and longer than that on the disc of the thorax, and with numerous more longer blackish hairs or sometimes intermixed with yellowish ones round the margin.

Wings, squamae, and halteres as in the female, but the former almost always much paler excepting of the yellowish costal cell.

Legs with longer pubescence than in the female, and with much more black hairs intermixed.

Abdomen longish, flat conical, broader than the thorax on the three basal segments and very longer than the head and thorax (including the scutellum) together. Dorsum mainly bright brownish orange with a narrow interrupted dorsal line and the tip black; basal segment black at the base but with the black colour suddenly narrowing to about from one-third to one-fourth of the hindmargin but not quite reaching it, and with the extreme sides blackish grey or grey; second segment with the middle sixth (or less) blackish brown but not quite to the hind margin and sometimes with its sides slightly darkened; third segment with the middle fifth (or less) black but also hardly to the hindmargin, and always with its sides slightly darkened; fourth segment normally with the middle thirds (or about quarter) and sides more extensively blackened, and often the intermediate space darker brownish orange or sometimes brownish black; fifth, sixth and seventh segments with the very narrow orange yellow hindmargins; there are small (though not inconspicuous) rather well-defined greyish yellow

tomentose shallow triangles furnished with yellow hairs at the middle of the second, third, and fourth (or sometimes to fifth) hindmargins, and the rest of each of those hindmargins has an orange fringe, and this fringe grows a little longer at the hind corners of each segment; fifth hindmargin with the yellow fringe restricted to the side quarters; sixth segment with longer yellow hairs at the sides; the remaining pubescence on the dorsum longer, dense, inconspicuous, and to a large extent black, and on the blackish portion of the basal segment there are some very short yellow hairs just under the sidemargins of the scutellum; sidemarginal pubescence black, except narrowly at the ends of the segments and on the sides of the first two segments. Belly orange or dark orange on the four basal segments except for a small blackish grey spot at the middle of the base in darker specimens, but the end segments blackish excepting of the narrow yellow hindmargins; pubescence dense, and black, but orange yellow on the hindmargins (except on the seventh segment) or in the paler specimens longer tuft on the middle base of the second segment orange yellow; seventh segment with several longer stiffer black hairs all about the middle.

Length: 19-20 mm.

This species has an appearance of *Therioplectes solstitialis*, Meig., but is easily distinguished from that by the absence of the ocelligerous tubercle. It is also allied to the paler form of *Tabanus exoticus*, Ricardo, but it is distinguished from it by the somewhat distinct yellowish grey stripes on the darker rather blackish thorax, by the longer tooth of the third antennal joint, by the lateral dark spots on the abdomen, by the facets of the male eyes all being equal, and by other minor points.

This fly varies but very little in the colour of the legs and of the abdomen, and in the amount of the black pubescence on the several parts, as already mentioned.

T. rufidens may be rather uncommon though it has rather a wide distribution, as I have records from Sapporo, Akaiwa, Jiozankei,

Gumma, Tokio, Kioto, Tsushima, Miyazaki, and Kumamoto, from 4th to 24th in August. I collected only a single female which was sucking blood, resting on the belly of rather a young horse, at nine o'clock in the morning, on the 24th of August, 1916, at Akaiwa, Hokkaido. There is no doubt that the female is a blood sucker.

Miss Ricardo states in the Records of Indian Museum Vol. IV, p. 245, that *Atylotus rufidens*, Bigot, may possibly be a denuded species of the subform *trigonus*, but I believe Bigot's species might be a valid one as many materials from Hokkaido quite identify with his original description, and these specimens quite differ from *trigonus*.

29. **Tobanus coquilletti**, Shiraki (n. n.) (Pl. VIII, fig. 4; Pl. X, figs. 12 & 13).

(Hatakeyama-Abu).

Tabanus tenebrosus, (nec. Walker, 1854) Coquillett, Proc. U. S. Nat. Mus., XXI, p. 310, 1898.

Kertesz, Cat. Dipt., III, p. 285, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 243, 1911.

A medium-sized blackish species, with a linear frontal callus on the narrow not parallel-sided greyish frontal stripe, with the reddish yellow antennae bearing the small dorsal hump, with five rather inconspicuous greyish stripes on the thorax, with the large brownish red or yellowish red lateral spots on the second segment, with the first posterior cell of the wings narrowed towards the margin, and with the blackish legs except the most basal part of the tibiae yellowish.

Female. Head not large, as wide as the thorax, slightly arched behind. Frontal stripe yellowish grey, narrow, very slightly contracting from the vertex to the lower end and about five times as long as its broadest part or wholly five and a half times as long as its narrowest part, bearing very short somewhat depressed yellowish grey pubescence

which is intermixed with rather abundant but scattered still short black hairs on about the upper two-third; frontal callus castaneous black, small, almost oval and with a very narrow linear upper extension which is about two and a half times as long as the callus proper, not touching the eye-margins; vertex more or less darker, covered with numerous stout but still short black pubescence intermixed with some yellowish inconspicuous hairs, behind which there is some short pale brownish yellow and black hairs but not very conspicuous. Frontal triangle greyish yellow, slightly raised from the eye-margins, with a very fine but distinct median sulcus throughout, and with the orange yellow tomentose but not very conspicuous double lunules just above the antennal fossae. Face moderately convex, covered with a yellowish grey tomentum; epistoma about as deep as wide, with a narrow and rather shallow lateral pits, more yellowish above, and bearing a amount of short soft yellowish pubescence on about the upper lateral corners, and on the rest bare; cheeks narrower than the half of the epistoma, paler towards the inner margin and below, covered with abundant but not dense very short inconspicuous yellowish white pubescence which rapidly grows longer about the lower part and on the jowls, and which is again shortened (but still long) on the lower part of the back of the head; absolute back of the head hollowed out and covered with a yellowish grey tomentum and some scattered whitish soft hairs; postocular bare rim not very broad, somewhat narrowed about the temple region, behind which is a short but comparatively long pale brownish yellow ciliation of numerous outstanding (not overlapping) hairs which become shorter about the lateral angles of the eyes. Proboscis dull black, rather small; the stalk bearing abundant somewhat long yellowish erect hairs behind; the sucker-flaps about twice as long as the stalk, and much darker, furnished with scattered brownish erect bristles beneath. Palpi pale brownish yellow, with the basal joint more or less blackish beneath; second joint slender and long, wholly four and a half or about five times

as long as its broadest part, broadest near the base and then looping and gradually narrowed to a blunt top, covered with numerous rather dense depressed black bristles almost all over the outside but the extreme base quite bare and on the lower basal margin with some slightly longer very thin very inconspicuous whitish hairs, the similar but shorter pale pubescence sometimes about the outer basal part, while the inner side is quite bare excepting about the tip with black bristles; basal joint small and narrow, about one-fourth as long as the second joint, covered with numerous long whitish hairs, and on near the outer tip there are some stout but short black bristly hairs. Antennae yellowish brown, with the broad basal annulation of the third joint reddish yellow and with the style-like portion blackish; the basal joint moderately thickened apically and hooked above over the base of the second joint, covered with numerous short depressed black pubescence almost all over the surface except on the underside nearly bare but there are some pale fine though longer inconspicuous hairs and a very few short black pubescence about the top; second joint moderately small, about a half as long as the basal one, less tomentose, the apex narrowly and forwardly produced above over the base of the third joint, and near it with a complete circlet of short black bristles which on the innerside more or less extend towards the base; third joint longer than the twice the length of the basal two joints together, with a very short dorsal hump near the base, and with a very blunt inconspicuous angle on the undermargin right below the dorsal hump, the hump and angle both more or less crowned with some very tiny black bristles; basal annulation of the third joint very broad and about one and a half as long as its broadest part, slightly darkened apically; the style-like portion wholly two-third as long as the broad basal annulation, with the basal three annulations subquadrate somewhat transverse, of which the middle one is shortest, while the apical conical annulation is slender and about twice as long as the just preceding one, each annulation bearing one or two or more fine inconspicuous pubescence near the

top. Eyes bare, with the facets small and practically equal in size, in death greenish black or deep purplish black, with some metallic ruster in a light; when seen from above the hind margin straight or very inconspicuously curved behind and one and a thirds as long as the frontal margin, the top angle about 100°, and the frontal angle about 70°; in profile irregular oval with the narrow roundish top angle, deeper than long, the frontal margin slightly convex; when seen from in front about as deep as wide, the facial margin very slightly convex and slightly longer than the frontal margin, the frontal angle about 135°, and the top angle about 90°.

Thorax somewhat longer than the width, blackish, moderately obscured by a greyish tomentum and covered with numerous short depressed yellowish pubescence which is intermixed with very abundant short conspicuous black hairs all over, and on about the anterior vertical part there are numerous longer oblique pale hairs, with five greyish yellow tomentose stripes of which the middle one is narrowest and does not extend to the hind margin, and the next pair is much well-defined extending to the posterior margin at where they are united with one another and connecting with outer pair at the suture, while the side stripes are broadest but interrupted at the praealar calli and after which they are separated into two narrow stripes by a small greyish dark brown interval and they are again united together on the postalar calli; humeri brownish obscured by a yellowish grey tomentum and covered with numerous long pale brownish yellow hairs, and on about the upper part there is a very few short blackish pubescence; praealar calli brownish black, covered with a yellowish grey tomentum and with somewhat abundant short stout black hairs which are curved towards several directions and are intermixed with some short recumbent golden yellow hairs, while on the lower margin there is a long black fringe of stout erect hairs which extend anteriorily on the space between the humeri and calli, and become longer there but somewhat thinner; postalar calli brownish, obscured by a whitish grey tomentum

and covered with hairs similar to those on the thorax, and on the postero-outer margin there is a long whitish tuft of soft hairs, the similar but shorter and less conspicuous one on about the upper wing-base. Pleurae densely clothed with a yellowish grey dust and bearing numerous not very long rather inconspicuous whitish yellow hairs which are almost entirely replaced by numerous longer conspicuous black hairs on the postero-upper half; prothorax and pteropleurae covered with abundant more longer very pale brownish yellow soft rather shaggy hairs; on the postero-upper margins of the meso- and meta-pleurae there is a long dense conspicuous tuft of very pale yellowish grey soft hairs. Scutellum as the thorax, but the black and yellow pubescence both more numerous and about the margin with a dense rather depressed yellowish pubescence.

Wings clear with the costal cell and stigma pale yellowish but the latter sometimes very slightly tinged with yellowish; posterior cells all widely open excepting of the first one which is contracting towards the margin, discal cell moderately large and apparently longer than the first posterior cell, and the anal cell closed with a long petiole; the upper branch of the cubital fork with the distinct recurrent veinlet. Squamae in the alar pair grey with a conspicuous black brown margin and a dense brown yellowish grey fringe (which is quite whitish grey when seen from a certain direction) except for a long yellowish tuft about the angle; in the thoracal pair yellowish with a broad brown or reddish brown margin and a brownish fringe of more fine hairs. Halteres blackish brown, with the extreme tip of the knob grey, and with the stalk more or less paler.

Legs blackish, with the coxae and femora densely dusted with yellowish grey, and with the basal half or more of the front tibiae and the almost entire of the last two tibiae pale brownish yellow; front coxae covered with a long pale grey soft pubescence, and near the top there are some short black bristly hairs; front femora at the extreme apex yellowish, with the shining castaneous black broad

subfemoral bare space which is transversely striolate and is hollowed out about the apical half or more, on the inner margin of this space with a short not very dense ciliation of black bristles, and on the outer surface there is a long conspicuous (not very dense) pale yellowish grey fringe intermixed with some rather inconspicuous blackish hairs on the apical part, the pubescence on the rest almost all black, very short, and depressed; middle femora with the extreme top yellowish, covered with numerous yellowish grey pubescence which grows up longer about the base and on nearly whole of the outside, while that on the innerside is quite replaced by rather dense but short depressed blackish hairs about the middle two-fourths or more; hind femora at the extreme tip yellowish and on about the apical half of the innerside quite bare from both the tomentum and the pubescence, on the rest covered with numerous pale yellowish grey pubescence which becomes conspicuously longer on the underside, while on the outside there are some very scattered short rather inconspicuous black hairs; front tibiae not dilated but moderately curved, with the apical two-fifth blackish brown, densely covered with short stout depressed black pubescence; middle tibiae very slightly tinged with brownish towards the tip, covered with short black pubescence as on the front tibiae, but less dense and intermixed with very short fine pale hairs on about the basal half except on the dorsal side, with the unequal spurs black with the base reddish; hind tibiae as middle pair, but the pubescence slightly longer and with black somewhat conspicuous two dorsal and one inner-ventral fringes of which the latter one is intermixed with numerous yellowish hairs; tarsi blackish but the last two pairs more or less brownish, covered with numerous tiny black bristles but the soles of the last two pairs reddish yellow; claws shining black, with the extreme base yellowish red; pulvilli dull brownish yellow.

Abdomen slightly broader than the thorax with a very slightly narrowly rounded anal apex, and longer than the head and thorax (including the scutellum) together. Dorsum black, with the large brownish

red or yellowish red lateral spots on the second segment which sometimes extend below to the third segment, wholly obscured by a greyish tomentum, with the narrow yellowish segmentations which are covered with a yellow pubescence which extends on the median triangles and more or less on the part of the lateral flecks of the usual *Tabanus* type, the pubescence on the rest all black and short, but that on the yellowish extreme sides of the segments yellow and slightly longer. Underside black with the very narrow yellowish segmentations, densely covered with a yellowish grey tomentum, but the lateral parts between the first two segments more or less reddish yellow, clothed with a short dense depressed yellowish pubescence which becomes blackish on the middle thirds or more throughout the whole length, but that on the posterior segments usually more extends towards the sides, while the seventh segment is covered with numerous long curved black bristly hairs.

Length: 19-19.5 mm.

I have to identified this species from the rather unintelligible description of Coquillett, and I am, therefore, a little uncertain whether it is correct or incorrect. However, the fact that there is no other species identical with his statement that is accepted by me and the above is described from such a species. This species may be rather uncommon in Japan as I have only two records from Sapporo (August) and Shibata (September), and is allied to *T. rufidens*, but easily distinguished from that by the more smaller dorsal hump of the third antennal joint, the broader frontal stripe, the quite restricted reddish lateral spots and very narrow yellowish segmentations of the abdomen, the conspicuously contracting first posterior cell of wings, and the abdomen on the underside quite blackish.

30. Tabanus fulvimedius, Walker (Pl. X, figs. 14 & 15).

(Taiwan-Kisuji-Abu).

List Dipt. Brit. Mus., I, p. 152, 1848.

Kertesz, Cat. Dipt., III, p. 243, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 197, 1911; Ann. Hist.-Nat. Mus. Nat. Hung., XI, p. 169, 1912; Suppl. Entom., III, p. 65, 1914.

Atylotus melanopygatus, Bigot, Men. Soc. Zool. France, V. p. 651, 1892.

Tabanus melanopygatus, V. d. Wulp, Cat. Dipt. South Asia, p. 63, 1896.

Kertesz, Cat. Dipt., III, p. 260, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 197, 1911.

Atylotus pagodinus, Bigot, Mem. Soc. Zool. France, V, p. 654, 1892.

Tabanus pagodinus, V. d. Wulp, Cat. Dipt. South Asia, p. 63, 1896.

Kertesz, Cat. Dipt., III, p. 267, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 197, 1911.

A medium-sized reddish brown species, with a large oblong shining black callus prolonged as a thick linear extension on the rather broad frontal stripe, with the greyish yellow-brown thorax, and with a greyish yellow median stripe on the abdomen.

Female. Head apparently broader than the thorax, very short. Frontal stripe yellowish grey to yellowish brown, almost always broadest as just below the vertex and then gradually narrowed downwards, and about five and a half or six times as long as its narrowest part or about three and a half or four times as long as its broadest part, furnished with very short mostly sloping black pubescence on the upper two-third but on the lower thirds with pale yellowish white one which sometimes very inconspicuously extends up to just before the vertex along the sides; lower frontal callus shining black, rather large and about twice or one and a half times as long as it is broad, usually

irregular elongate with the upper end often sharply notched not reaching the eye-margin ; the upper frontal callus longer than or sometimes about twice as long as the lower one and about two-thirds as wide as that, the both calli being connected by a short narrow line, one so described as the front callus has a rather thick linear upper extension ; vertex without any ocelligerous tubercle, covered with rather dense somewhat depressed short black pubescence, behind which are some short (though a little longer than those on the vertex) outstanding black hairs which are not conspicuous. Frontal triangle convex, rather transverse and about three (or more) times as wide as it is long, covered with a dense reddish brown or reddish yellow tomentum, the very fine inconspicuous middle sulcus throughout the whole length. Face greyish yellow or pale yellowish grey, somewhat yellowish brown tinged above ; epistoma moderately raised and apparently broader than the length, with rather large and deep lateral pits, bearing some rather sparse short but most fine blackish pubescence which is more conspicuous near the lateral upper corner, while the spaces just above the mouth part and just below the antennae are almost always bare from pubescence ; cheeks rather narrow, conspicuously tinged with yellowish brown (or paler) at the upper end and along the eye-margin, covered with numerous but not dense fine yellowish pubescence which is usually replaced or rarely intermixed with blackish hairs similar to those on the epistoma, on the upper half or more, especially conspicuous along the eye-margin ; jowls paler than the cheeks, covered with rather dense longer somewhat shaggy yellowish pubescence which is hardly extended up to the back of the head ; back of the head shallow on the lower half and moderately hollowed out on the upper half, pale yellowish grey but about the middle part of the upper half yellowish brown or brownish yellow, very sparsely covered with rather soft pale brownish yellow pubescence ; postocular bare rim narrow but comparatively broad, equal through the whole length but very slightly narrowed near the vertex, pale yellowish grey to greyish yellow and almost

always more yellowish than the jowls, behind which is a conspicuous yellowish brown ciliation which is usually intermixed with some thick blackish hairs about the temple region or sometimes from the upper ends to the jowls. Proboscis rather stout and short, about two-thirds as long as the depth of the head, dull brownish black; the stalk usually obscured by some yellowish grey tomentum, and bearing some yellowish pubescence behind and with more or less brownish somewhat bristly hairs at the sides; sucker-flaps large and longer than the stalk, furnished beneath with comparatively long scattered brownish black bristly hairs intermixed with a few shorter yellowish white hairs. Palpi in the end joint luteous but varying to dull brownish yellow, usually almost obscured by short dense depressed black bristles amongst which on the basal part (especially above) or sometimes throughout the outer surface are some less distinct thin smaller yellowish bristles intermixed, but sometimes the numerous short black bristles are almost confined to the apical (or rarely basal) two-thirds and occur only very sparsely before or rarely after the middle, while the basal part (or nearly apex) has only the smaller thin inconspicuous yellowish bristles; the second joint of the palpi nearly five times as long as their broadest part, somewhat broad from the base up to about the middle, after which they droop and gradually diminish to a moderate point or a round tip, quite bare on all the innerside but with a few longer pale hairs beneath about the base; basal joint narrow wholly four times as long as the end joint, usually darker than the first joint, covered with long numerous soft yellowish hairs. Antennae slender and long, reddish yellow with two basal joints pale orange yellow and with the tip dark brown; basal joint covered with numerous comparatively long black bristly hairs on the upper and outer side, but on the innerside some inconspicuous pale hairs which are very rarely intermixed with a few black bristles and near the apex of the underside a few long blackish pubescence, moderately thickened at the end and about one and a half times as long as its broadest part, extending somewhat cap-like over

the short second joint and this second joint with a rather short upper end-process and with a circlet of short black bristles around the tip which are rather longer on the underside ; third joint about three times as long as the basal joints together, and its broadest part hardly wider than the thickest part of the first joint, with a small dorsal hump crowned with a few tiny black bristles apparently before the middle or near the base of the first annulation ; basal annulation of the third joint wholly two and a half times as long as its broadest part, with the lower margin not straight but slightly bent below near to the middle rather than to the base, this bend usually bearing two or three inconspicuous very tiny black bristles ; style-like portion brownish with the apical annulation almost always blackish, wholly one and a half times as long as the rest of the third joint, the three basal annulations about the same in length and width and each one nearly quadrate but very little wider than length, the apical one somewhat conical and about one and a half as long as the preceding annulation, each annulation bearing two or three fine pubescence about the tip but on the apical one there is a few more fine inconspicuous pubescence on the underside. Eyes bare from pubescence, and with the facets all equal in size, in death deep greenish black with some metallic shimmer in a light, and with three inconspicuous deep purplish bands which are almost parallel with one other and are upturned at the outer ends, and which are vaguely united together about the rounded outer-angle of the eyes, of which the middle one is usually narrowest and extends from just above the frontal angle to about the middle of the outer margin, while the upper band is less curved and is shortest, the lower one being broadest and longest ; when seen from above the frontal margin wholly two-thirds as long as the hind margin which is nearly straight and usually rather convex, the outer margin slightly but moderately curved outwards especially about the posterior thirds, the top angle about 100° and the frontal angle about 60° ; in profile irregular ovate, and about two-thirds as long as it is deep, the frontal

margin nearly straight (very slightly convex), the hind margin moderately convex, and the lower margin strongly convex; when seen from in front about as wide as deep, the facial margin very slightly covex and apparently shorter than the frontal margin, the frontal angle roundish, about 130°; and the top angle about 90°.

Thorax somewhat quadrate with the angles roundish, pale yellowish grey to greyish yellow-brown, with five short very inconspicuous (one so described as no stripe exists) yellow or reddish yellow stripes only at the anterior border of which the lateral pair is usually more distinct, and broadest, and extends from the humeri to the postalar calli, but they are interrupted by the suture and then suddenly narrowed hindwards; pubescence on the disc numerous, short, depressed, pale yellow, intermixed with rather abundant longer erect conspicuous black hairs; humeri rather distinctly paler, covered with not dense though numerous long pale yellowish grey hairs which become whitish about the inner-lower third; praealar calli usually darker than the disc of the thorax, clothed with abundant long erect somewhat shaggy black pubescence which is slightly shortened about the upper half or less on where it is intermixed with some yellow recumbent hairs; postalar calli pubescent as in the disc of the thorax but on the postero-outer margin there is a somewhat yellowish tuft of rather dense curved hairs, similar but shorter tuft just above the wing-base and front where are some stout very short black hairs. Pleurae paler than the thorax, usually pale yellowish grey or greyish yellow, covered with numerous not very long yellowish grey or pale brownish yellow soft hairs which become more conspicuous and longer towards the sides; prothorax covered with numerous longer soft yellowish grey hairs, on the postero-upper margins of the meso- and meta-pleurae there are much longer dense greyish yellow tufts, and about the postero-upper corner there are numerous long rather shaggy yellowish grey hairs.

Wings rather distinctly tinged with brown, with the costal cell usually yellowish, and sometimes with the basal part and the submarginal

cell yellowish; posterior cells all widely open but the first and fourth ones sometimes very slightly narrowed towards the margin; anal cell closed moderately long before the margin; discal cell not very large, slightly longer than or about as long as the first posterior cell; the upper branch of the cubital fork almost always bearing a recurrent veinlet but often wanting it. Squamae in the alar pair dark grey with a rather blackish margin and an inconspicuous pale fringe excepting on the moderately long pale orange yellow tuft about the angle, in the thoracal pair orange yellow with a slightly brownish margin and a more conspicuous brownish fringe. Halteres brown, with the knob dark brown but its top almost always pale yellowish grey.

Legs dull blackish brown to dull brown, with all the tibiae (except about the apical part) and the extreme tips of the femora yellowish; fore coxae dilated and about three-fourth as long as the fore femora, covered with a dense yellowish grey tomentum and with numerous long pale yellowish grey pubescence which becomes shorter towards the apex but there is no blackish pubescence; femora slightly covered with a pale yellowish grey tomentum leaving a broad shining dark castaneous subfemoral bare space which is very finely transversely striolate and is somewhat hollowed out but very narrowly (or sometimes entirely not), at the inside of this space bearing short black ciliation of numerous rather dense somewhat bristly hairs, pubescence on the outside long, erect, yellowish and blackish, which becomes shorter and sloping on the upper margin, while the pubescence on the innerside much shorter, depressed, all black; middle femora almost always slightly paler than the front pair, slightly covered with a yellowish grey tomentum, and bearing numerous short depressed yellowish pubescence which becomes more erect and conspicuously longer on the outer-lower side; hind femora coloured, tomentose, and pubescent similarly as the middle femora, but the pubescence only lengthened on the underside; front tibiae narrow, very slightly curved, apical two-third blackish but gradually palened towards the base, pubescence very

short and depressed, on the blackish part black and on the yellowish part yellow, bearing two or three or more fine not very long blackish touch-hairs near the apex of the underside; middle tibiae about the apical fourth brownish or blackish, covered with numerous short depressed pale yellow pubescence which is nearly all black on the blackish part and sometimes is intermixed with some scattered similar but black hairs on the lower and upper sides, bearing two rather large unequal blackish spurs with the basal half yellowish; hind tibiae as the middle tibiae, but the pubescence on the upper side somewhat conspicuously longer; all the tarsi dark brown but the front pair rather black, covered with numerous tiny depressed black pubescence, the touch-hairs on the underside of the front tarsi conspicuous, the soles of the two posterior pairs deep reddish yellow; claws all shining black, and the pulvilli dull orange yellow.

Abdomen broader than the thorax and much longer than the head and thorax (including the scutellum) together, slightly narrowed to a large roundish apical end. Dorsum blackish, with the two basal segments more or less dull orange or yellowish brown but usually dark brown on the large middle part or sometimes almost all the disc leaving only the lateral parts, with the large grey or yellowish grey tomentose and grey or yellow pubescent more or less triangular median spots on each segment, forming a continuous stripe, and with very narrow yellow or pale brownish yellow segmentations which bear rather sparse short yellowish fringes of very fine hairs which become stouter and longer and usually yellow to deep orange colour towards and at the pale yellowish brown or reddish brown sides, on where the pubescence is yellow and long, pubescence on the rest all depressed and black. Ventre as the dorsum, but quite obscured by a dense yellow tomentum and by a dense depressed somewhat golden yellow pubescence which is yellowish brown when seen from side or behind; seventh segment covered with numerous long oblique brown or blackish somewhat bristly hairs.

Length: 13–17.5 mm.

Male. I have no specimens, and Miss Ricardo described the male as follows:

The males are more reddish brown in colouring than the females. Eyes with the large facets occupying two-thirds of the surface, about reaching to the base of the frontal triangle, next the subcallus, and reaching the vertex. Palpi yellow with yellow and brown hairs. Beard and hairs on face yellow, some brown ones on the cheeks. Abdomen reddish brown on the first three segments, then blackish, the median yellow haired stripe narrower than in the female; underside reddish yellow, a little darker at apex. Legs more wholly reddish yellow. Wings tinged yellowish, no appendix is present.

This species varies a little in the amount of yellowish brown or dull orange colouring on the first two segments of the abdomen, this colouring extending slightly below to the third segment in some specimens from Kanshirei and Horisha in Formosa, in the colouring of the frontal stripe, the thorax, and the median stripe on the abdomen from deep greyish yellow or yellowish brown to whitish grey, and the amount of the black pubescence on the legs especially on the tibiae; a female from Horisha (May 10th, 1913) has rather short and thick antennae which have much broader (about one and a half times as long as it is broadest) basal annulation of the third joint, and also have a thick and short style-like portion with a short bluntly pointed apical annulation and with the remaining ones apparently transverse, and this female has a broad parallel-sided ashy grey frontal stripe containing a shining black broad and comparatively short callus, and its thorax and abdominal stripes are ashy grey, as well as its palpi are very slender, almost the same width throughout, with a rounded tip.

T. fulvimedius appears to be a common species in the mountainous districts of the lower half of Formosa, as I have records from Horisha (April 10th to May 25th), Kanshirei (April), Kosempo (May), Sokutsu (June), Fuhosho (May), Mansu (May), and Toyenmongai (May), but it

is rather rare in the fields, one record only being from Garanbi (April 21st) near Koshun. It has been recorded from Burma and India, from where the specimens usually have the first three abdominal segments reddish brown, and their wings are less distinctly tinged with brown.

I have but little knowledge of the bite of the female fly, as I only once chanced to meet a female biting the belly of Formosan cattle, dragging a kind of car, near Horisha, about 2 o'clock in the afternoon on a bright day in May of 1917.

31. **Tabanus chrysurus,** Loew. (pl. VIII, fig. 5).

(Aka-Ushi-Abu, or Yezo-O-Abu).

Wien. Ent. Monatschr., II, p. 103, 1858.

Portschinsky, Horae Soc. Ent. Ross., XXVI, p. 202, 1891.

Coquillett, Proc. U. S. Nat. Mus., XXI, p. 309, 1898.

Matsumura, Thous. Ins. Japan, II, p. 74, pl. XXII, fig. 7, 1905,

大日本害蟲全書, 後編, p. 71, pl. X, fig. 11, 1914.

Kertesz, Cat. Dipt., III, p. 234, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 237 1911.

臨時馬疫調查會委員研究成績(馬政局)第二稿, pl. V, fig. 1, 1914.

Atylotus pyrrhoceras, Bigot, Ann. Soc. Ent. France, (6) VII, Bull., p. LXXVII, 1887.

Tabanus pyrrhoceras, Kertesz, Cat. Dipt., III, p. 272, 1908.

Ricardo, Rec. Ind. Mus., IV, p. 237, 1911.

A very large blackish brown species, with the triangular frontal callus on the broad parallel-sided deep orange yellow frontal stripe, the rather well-defined four brownish yellow stripes on the thorax, the conspicuous rather broad deep orange yellow segmentations of the abdomen, the blackish brown legs except all the tibiae yellowish, and the brownish yellow tinged wings, being the bulkiest Japanese fly.

Female. Head as wide as the thorax and about a half as long

as that, slightly arched behind. Frontal stripe deep orange yellow or sometimes very slightly tinged with brownish, and somewhat paler at the lower fourth or less, broad (not comparatively rather narrow) parallel-sided but sometimes very slightly contracting below, covered with dense short depressed pale brownish yellow or rich orange yellow pubescence which grows sparse on the lower part at where it becomes paler; frontal callus blackish castaneous, slightly raised with a fine inconspicuous median sulcus throughout, elongate triangular with the lower margin nearly straight and with the tip sharply pointed but not well prolonged above as Loew described, about twice as long as its broadest lower margin, quite separated from the eye-margins by rather narrow intervals; vertex somewhat paler but obscured by short erect blackish or brownish pubescence which at the lateral parts is intermixed with some yellowish depressed hairs extended up from the forms, behind that is a short brownish black fringe but not conspicuous nor overlapping; frontal triangle moderately raised, deep orange yellow or pale brownish yellow, on the upper margin with a narrow brown or blackish brown not straight but slightly curved below transverse line which is quite interrupted in the middle third or less or sometimes more, and which does not usually touch to the frontal callus. Face strongly convex, deep orange yellow and usually with a slight brownish tinge especially about the mouth-edge and near the eye-margins; epistoma much broader than deep, almost bare but about the upper lateral corners bearing numerous short erect light brownish yellow pubescence, the lateral pits rather small and shallow; cheeks narrow, about one-thirds as wide as the epistoma and nearly equal width throughout, covered with numerous rather dense short fine pale brownish yellow pubescence which is rather inconspicuous and does not apparently grow longer below but on the jowls it is rapidly lengthened and well conspicuous, this long pubescence on the jowls somewhat extending up to the back of the head which is shallow at the lower part and is hollowed out above; back of the head yellowish grey, furnished with numerous

moderately long conspicuous pale brownish yellow soft hairs all over, and with the narrow similarly coloured postocular rim which is almost always equal in width throughout and behind which is a comparatively short but dense pale yellow brown ciliation which does not interfere into the pubescence behind the vertex but somewhat extends below to the jowls. Proboscis dull brownish black, moderate in size and about two-thirds as long as the depth of the head; stalk rather narrow, covered with a brownish grey tomentum and with erect sparse pale brownish yellow pubescence behind, while on the side there are some short sparse brown somewhat bristly hairs; sucker-flaps rather large, about as long as the stalk, furnished with shorter blackish, brownish, and yellowish bristly hairs on the underside. Palpi very slender and long, brownish yellow; the basal joint short cylindrical, wholly one-fourth as long as the end joint, brown with a slight reddish tinge, covered with numerous long erect yellowish brown hairs which are quite yellowish in a certain light and which become shorter towards the tip; second joint almost always slightly darkened about the base especially on the underside, covered with numerous dense short depressed deep orange yellow pubescence which can seen a pale yellowish brown one in a certain light, and on the lower half or less of the outside there are some scattered short depressed black bristles intermixed, this joint broadest near the base and then moderately drooping and gradually narrowed to the narrow rounded top, and its length more than four times its broadest part. Antennae reddish yellow with the two basal joints brownish yellow and with the style-like portion reddish brown; basal joint about one and a half times longer than its broadest apical part, at where it above is moderately hooked over the base of the second joint, covered with numerous dense short depressed golden yellow pubescence which is quite bare on the underside and becomes very sparse at the lower half of the outside where are numerous black conspicuous hairs which extend above and round almost all the apical margin, while at the apex of the bare underside there is a few short

inconspicuous paler pubescence; second joint very small and about one-thirds as long as the first joint, with a moderately long, spine-like apical process above, and covered with tiny inconspicuous rather sparse black pubescence (except on the base of the underside where it is quite bare from any pubescence) intermixed with more inconspicuous tiny pale brownish yellow hairs which become slightly longer and much conspicuous along the apical margin especially on the inner underside, in fact one may sometimes almost say that the second joint bears apical circlet of pale bristles; third joint about two and a half times longer than the first two joints together, the basal annulation very much broadened, about one and a half times as long as its broadest part, with a long tooth which directs forwards and is almost as long as two apical annulations of the style-like portion, and its top crowned with some tiny black bristles, the lower margin strongly curved (or bent about 125°) below before its middle, and bearing a few very tiny inconspicuous yellowish brown pubescence about this bend; style-like portion shorter than half of the broad basal annulation of the third joint, rather narrow, each annulation gradually lengthened towards the apex but the first two annulations rather transverse, the third one slightly longer than wide, and the apical one longer than the preceding one and elongate-conical with a rather sharp point, one or two or more tiny inconspicuous pubescence on each annulation. Eyes bare with the facets all equal in size, in death deep purplish black or deep brownish black, with a metallic shimmer; when seen from above the hind margin almost always straight and about one and a half times longer than the frontal margin, the outer margin moderately convex nearly evenly, the top angle about 110°, and the frontal angle about 80°; when seen from in front slightly broader than it is deep, the facial margin very slightly convex and shorter than the frontal margin, with the frontal angle wholly 135° and with the top angle about 90°; in profile irregular round, with the top angle nearly angulated but still roundish, as long as deep.

Thorax roundish, about as long as wide, castaneous black, with rather well-defined yellow or brownish yellow stripes, of which the median pair are narrower but extending from the anterior margin to the posterior margin and at the suture they are outwardly curved and swallen and after that gradually approaching each other towards the hind margin but not touched with one another although very often the intermediate space on the hind third is obscured by a yellowish tomentum, while the anterior two-third of the intermediate space bears a very fine yellow or brownish yellow median line which in a denuded specimen can not almost always seen, the lateral pair of the stripes very broad, from the humeri to the end of the postalar calli running over the praealar calli, but almost quite interrupted at the base of the wings behind which they become narrower, rather inconspicuous, and more brownish, each outer stripe being connected with the median stripe at its posterior end and at the suture by a narrow yellowish line ; pubescence on the disc numerous, short, black but that on the yellowish stripes pale brownish yellow (with a golden shimmer), while on the anterior border there are rather numerous slightly longer conspicuous pale hairs ; humeri rather small though conspicuous, covered with numerous rather long pale brownish yellow pubescence ; praealar calli with a somewhat conspicuous brownish yellow fringe intermixed with some black hairs which become conspicuously dense posteriorily and often extend forwards to near the humeri or sometimes up to the middle of the calli ; postalar calli covered with numerous dense short dark brownish pubescence on the anterior end and bearing a somewhat conspicuous yellow or pale brownish yellow or brownish yellow tuft at the postero-outer margin, the similar but very short tuft at the upper bases of the wings which is very often replaced by blackish brown one. Pleurae almost all covered with a brownish yellow tomentum but on the anterior part usually with a deep orange yellow dust, clothed with a moderately long brownish or blackish pubescence which on the outer-upper half of the mesopleurae and on the anterior

border usually pale brownish yellow; prothorax and pteropleurae covered with a greyish yellow or yellow tomentum aud with numerous long somewhat shaggy pale brownish yellow or reddish yellow hairs; the postero-upper margin of the meso- and meta-pleurae bearing the long dense brownish yellow tuft. Scutellum covered with a yellowish brown tomentum, not shining, and clothed with numerous rather dense black pubescence which is intermixed with some scattered short rather depressed brownish yellow (with dense golden rustre) hairs, and on the margin there are numerous dense not long brownish yellow tuft which has some golden shimmer in a light.

Wings shorter than the thorax and abdomen together, slightly infuscated but rather distinctly tinged with yellowish along all the veins and at the extreme base, and more or less clear about the middle of the cells excepting of the costal and subcostal cells conspicuously yellowish, with the veins almost all brown; posterior cells all widely open but sometimes the first one slightly contracted towards the margin, anal cell closed with a long petiole, and the discal cell large and about twice as long as the second posterior cell; upper branch of the cubital fork without the recurrent veinlet. Squamae in the alar pair grey with a dark brown narrow margin and with a short but dense yellowish brown fringe except for the long dense conspicuous rather golden yellow tuft about the angle; in the thoracal pair pale yellowish brown with a rather broad brownish yellow margin and with a rather sparse ciliation of very fine brownish hairs which are shorter and more inconspicuous than those in the alar pair. Halteres comparatively small, brown or dark brown with the knob blackish but its top more or less yellowish grey.

Legs castaneous black, with the apex of the femora and with tibiae yellowish, and with the tarsi brownish; front coxae moderately dilated and about three-fourth of the front femora, covered with a greyish yellow tomentum and with numerous long pale brownish yellow hairs which have a golden shimmer in a light and which on

the innerside is intermixed with rather numerous shorter black pubescence, this black hairs being often extend nearly throughout except on about the basal outer part and also sometimes on the inner part; front femora slightly covered with a yellowish brown tomentum leaving the broad shining subfemoral bare space which is not very conspicuously transversely striolate and is hardly hollowed out but rather convex, on the inner margin of this bare space with a short but dense dark brown or black ciliation, on the outer side with a moderately long dense black fringe, and pubescence on the rest all short depressed and black, except on the pale reddish brown or yellowish red apex pale yellowish brown or reddish yellow; middle femora more castaneous than the front pair and their apex more broadly pale reddish brown or yellowish red, covered with numerous dense rather depressed black pubescence which becomes paler at the apex and grows longer on the outside as a broad fringe, while the underside very often is very narrowly bare from pubescence throughout the whole length, this bare space being striolate as that on the front femora but dusted like the rest; hind femora coloured and dusted as in the middle pair, covered with numerous rather dense short black pubescence (except on the rather broad bare inner side) which grows longer on the underside and which on the apical part becomes paler, while on the dorsal base there are some conspicuously long black hairs; the pale pubescence on the apices of all femora often but rather sparsely extends up to about the middle or more further and consequently interferes into the black pubescence, especially on the side long and conspicuous, and the black pubescence on all the femora sometimes becomes dark brown, being in less extent; front tibiae at the apex slightly tinged with brownish, and on the underside somewhat pale reddish brown, covered with numerous very short depressed pale brownish yellow pubescence which is orange yellow when seen from a certain direction, and on the upper and inner sides of the apex there are some similar but black hairs, the touch-hairs on about the ventral apical part comparatively

short and rather inconspicuous; middle tibiae somewhat pale reddish brown towards the top, pubescent similarily as in the front pair but there is no black hairs, the spurs unequal and brown with the tip black or blackish; hind tibiae like the middle pair but with one ventral and two dorsal short rather inconspicuous pale brownish yellow fringes; tarsi gradually tinged towards the tip with dark brown, excepting of the front pair black or blackish black, covered with dense very short depressed black bristles which on the basal joint of the posterior two pairs are intermixed with good many or a few pale reddish brown or sometimes brownish yellow bristles especially in the hind pair and sometimes those joints all covered with paler bristles; the soles usually reddish brown or brown but in the front tarsi almost always much darker; the touch-hairs on the front tarsi rather short and rather inconspicuous; claws all shining black with the base more or less brownish yellow, the pulvilli dull orange or yellowish brown.

Abdomen rather flat, apparently longer than the head and thorax (including the scutellum) together, broader than the thorax, and slightly narrowed towards the anal end at where it is broadly roundish. Dorsum castaneous black, with the broad greyish yellow tomentose posterior band on each segment, the bands on the last two or three segments occupying all the surface as one could say that the posterior segments yellow, while the other bands in the middle flat-triangularily extend up to about the middle of the length of the each segment and they are more or less roundly notched at the sides of the middle part, but on the first segment nearly interrupted there, each band being broader one behind other, and extending to the sides; pubescence on the disc short dense depressed and black, but on the bands pale brownish yellow with some golden shimmer; the side-hairs not specially conspicuous, though slightly longer, mostly black but on the yellow broad posterior border of each segment yellow, this yellow pubescence often extending up to near the anterior margin of each segment. Ventre castaneous black, slightly shining, with the greyish yellow tomentose hind band on

each segment except the first, each band more or less roundly and broadly notched at the middle part, this being mainly caused of the extension of numerous dense short depressed pale brownish yellow or reddish yellow pubescence on the bands; pubescence on the rest short thin and black, but on the seventh segment there are numerous longer conspicuous pale brownish yellow somewhat bristly hairs and are no black pubescence, while on the sixth segment there is a few black one only at the middle of the anterior margin.

Length: 25–30 mm.

Male. As the female but much smaller, with the abdomen shorter than the head and thorax (including the scutellum) together. Head very large, broader than the thorax but shorter. Frontal triangle comparatively small, orange yellow with the upper angle brown tinged and prolonged narrowly a short distance between the eyes, the median longitudinal sulcus fine though conspicuous and entire throughout, on each lateral division there are one or two or more unwell-defined irregular transverse furrows which often are hardly recongisable. Face longer than its widest lower part, greyish yellow or orange yellow; epistoma deeply sunken, elongate triangular with the tip cut transversely, more tinged with yellow above and quite bare; cheeks moderately inflated, parallel-sided with the oblique upper margin, obscured by rather short but dense soft pale brownish yellow pubescence which grows rather suddenly longer about the jowls; back of the head hollowed out but slightly on the lower part, greyish yellow or yellow, covered with numerous yellowish soft hairs which become much sparser above, with the pale brownish yellow posotcular bare rim very narrow and gradually but slightly broadened from the top angle to the jowls, behind this rim very short but dense yellowish brown or brown ciliation which never enters into the vertex but extends below to the jowls at where it becomes slightly longer though rather sparse; vertex very narrow, elongate-eliptical, slightly raised from the eye-level, with a more or less distinct longitudinal sulcus and with a few short yellowish brown

or pale brownish yellow curved pubescence behind. Proboscis rather slender, about a half as long as the depth of the head, blackish brown; stalk narrower than the sucker-flap, covered with rather numerous long yellowish brown soft hairs; sucker-flaps very short and stout, furnished with short scattered brown bristly hairs. Palpi very small yellowish brown or reddish brown; basal joint narrow, about from three-fifths to two-thirds as long as the end joint, darkened below about the basal half, and covered with numerous long yellow or pale brownish yellow pubescence; second joint elongate, gradually thickened from the base to after the middle and then rather rapidly contracted to a bluntly rounded end, about twice or two and a half times as long as its thickest part, bearing numerous depressed black bristly hairs on the outerside with a few yellow ones usually intermixed, and with sparser yellowish hairs inside and upper base, the black bristly hairs sometimes being rather few and replaced by numerous yellowish ones. Antennae as in the female but very smaller, with the apical circlet of the second joint often compound of black bristles only, with the apical process usually comparatively longer, and with the basal joint so more thickened apically as it is about as long as wide. Eyes very large, quite bare, in death blackish with some coppery shimmer but the area occupied with large facets brownish red; the front facets all much enlarged and contrasted with the small facets on the lower third and on the narrow (but not very) marginal zone which extends equally right up to the vertical space; the enlarged facets extend undiminished up to the touching part of the eyes; the contrasting line of facets begins at near the top of the frontal triangle and loops down right across the eyes to the narrow zone, leaving the widest part of the small facets at about the middle of the head (when viewed sideways); the eyes touch for about two and a half times the extreme length of the frontal triangle.

Thorax roundish, about as long as wide, and slightly longer than the head, very similarily coloured and haired to that of the female but with the black pubescence very much longer and more conspicuous;

pleurae as in the female but the pubescence longer, more dense, and more conspicuous, especially the black pubescence, on the posterior half of the mesopleurae much more dense; scutellum also as in the female but with longer pubescence.

Wings more clear than in the female, with the veins yellowish or brownish. Squamae with more brownish margins. Halteres more brownish.

Legs as in the female, but rather short; the outer fringe of the front femora and the lower fringe of the middle and hind femora longer and composed only of black hairs.

Abdomen not conical but the apical four segments forming a very short flat conical, shorter than the head and thorax (including the scutellum) together and broader than the latter, much more blackish than in the female, with the narrower reddish yellow or deep yellow segmentations which are notched and haired as in the female, pubescence the rest also as that in the female but slightly longer especially on the lateral parts; genitalia rather small, brownish with the tip reddish yellow, covered with numerous pale brownish yellow pubescence intermixed with some blackish hairs.

Length: 22–22,5 mm.

The description of the male is from four flies which are well-preserved specimens from Towada (July 25th), Sapporo (August 20th), and Onuma (August 18th).

This species varies but a very little in both sexes as mentioned above, and it is easily distinguished from any other Japanese species of the restricted genus *Tabanus* by the four stripes on the thorax and the abdominal yellow bands; one species of Japanese *Therioplectes* has the yellow bands on the abdomen but *tarandinus*, Lin., has no thoracal stripes and is much smaller, and it has the distinct ocelligerous tubercle; Miss Ricardo placed *T. buddha*, Port., in her Revision of the Species of Tabanus from the Oriental Region, 1911, as a Chinese subform of *chrysurus*, and it may be really so, but I now take the name *buddha*

as a specific one until I can compare them, because there is no specimens bearing no pubescence on the basal joints of the antennae, and bearing the quite rounded frontal callus, in the good number of this species collected from many localities in Japan.

T. chrysurus is a rather widely distributed Japanese horse-fly, as I have records from Matsuyama, Kioto, Yamato, Towada, Shirakawa, Onuma, and Sapporo, but there is no doubt that this fly is rather a northern species occuring abundantly in Hokkaido, the dates ranging from July 15th to September 18th. in August its appearance being most numerous.

The female flies are usually feeding on the blood of cattle but not uncommon on horses, and it is believed by many veterinary surgeons, after the several and careful studies in the Isano Experimental Station from 1910 to 1913, that one of transmitters of a certain infectious anoemia of horses is this large species. The females also sometimes bite human beings and the effect usually is more severe than that of any other our species.

32. Tabanus pallidepectoratus, Bigot.

Atylotus pallidepectoratus, Bigot, Mem. Soc. Zool. France, V, p. 658, 1892.

Tabanus pallidepectoratus, V. d. Wulp, Cat. Dipt. South Asia. p. 63, 1896.

Kertesz, Cat. Dipt., III, p. 267, 1908.

Ricardo, Red. Ind. Mus., IV, p. 209, 1911; Ann. Nat.—Hist. Mus. Nat. Hung., XI, p. 172, 1913.

A robust reddish yellow species, with a very narrow frontal stripe and frontal callus, reddish antennae, yellow palpi, black legs, only the tibiae whitish at the base, and clear wings tinged yellowish brown.

Length 22 mm.

Female. Face covered with greyish tomentum which becomes yellowish brown on the upper parts of cheeks, on subcallus and fore-

head, pubescence on face of white hairs, with darker ones on cheeks. Beard white. Palpi yellow with thick black pubescence, the first joint with the upper angle produced, the third joint reddish with a small tooth, dusting at its extreme apex. Forehead about ten times as long as it is broad, and a third narrower anteriorly, the frontal callus reddish brown, long, narrow, not reaching the eyes; with a rather thick lineal extension. Thorax brown covered with yellowish brown tomentum, denuded, pubescence remaining is chiefly yellowish, on shoulders and at sides chiefly black; breast covered with greyish tomentum Scutellum similar to thorax. Abdomen fulvous, a little browner on the anterior borders of third, fourth and fifth, and almost wholly blackish brown on the last two segments, pubescence short, golden yellow, scanty, thickest on the segmentations, black on the last two segments; under side darker, reddish brown with paler under segmentations, appearing banded on anterior segments, at apex wholly dark, pubescence golden yellow only on segmentations, black elsewhere. Legs black, knees and basal third of all the tibiae whitish with some yellow hairs, fore coxae with pale hairs, elsewhere the pubescence is black. Wings tinged yellow-brown on fore border, veins and stigma yellow.

Male. The eyes have the upper two thirds occupied by the large facets which reach beyond the apex of the frontal triangle and to the vertex, but beyond the vertex they begin to recede, leaving a gradually wider border of the small facets. Palpi yellow with black hairs. Face covered with yellow tomentum and with yellowish brown hairs. Abdomen similar to that of female; under side with blackish bands which almost entirely occupy the last five segments, the segmentations fringed with yellowish pubescence, the seventh wholly blackish.

I have no specimens, and the above description is from Ricardo's statement. It is known to us that this species occurs in Saigon, Tongking and Formosa.

33. **Tabanus candidus,** Ricardo.

Ann. Hist.-Nat. Mus. Nat. Hung., XI, p. 172, 1913.

A species near *Tabanus birmanicus*, Bigot, but quite different. A large black species with a white haired thorax and scutellum. Thorax sharply distinguished from the dull deep black abdomen. Antennae, legs and palpi blackish. Forehead narrow. Length: 21 mm.

Female. Face covered with dark brown tomentum and with black hairs in centre below antennae and on the cheeks. Beard blackish brown. Palpi blackish, slightly stouter at base, ending in an obtuse point. Antennae blackish, the third joint somewhat reddish brown, the first two joint with a little black pubescence. Subcallus and forehead the same colour as face, some greyish tomentum on forehead above the frontal callus. Forehead about seven times as long as it is broad, hardly half the width anteriorly, that it is at vertex, frontal callus black, narrow, not reaching the eyes, its short extension nearly equal in width, ending in a point. Thorax brownish, with a blackish brown central stripe and less defined lateral ones, dorsum covered with thick appressed silvery white pubescence, some black hairs intermixed, especially on the stripe. Scutellum the same. Legs black with black pubescence. Wings tinged smoky brown, with white streaks in most of the cells, veins blackish brown.

This species is not known to me, and the above is Ricardo's description from only a single specimen collected by H. Sauter at an unknown place in Formosa.

34. **Tabanus birmanicus,** Bigot. (pl. VIII, fig. 8; pl. XI, figs. 13 & 14)

(Birma—Abu)

Atylotus birmanicus, Bigot, Mem. Soc. Zool. France, V, p. 653, 1892.
Tabanus birmanicus, V. d. Wulp, Cat. Dipt. South Asia, p. 63, 1896.
Kertesz, Cat. Dipt., III, p. 228, 1908.
Ricardo, Red. Ind. Mus., IV, p. 200, 1911.

A medium-sized brownish black species with deep yellowish brown thorax, wings tinged dark brown, legs black with distinct white tibiae and a narrow frontal stripe.

Female. Head broader than the thorax, with the hind margin very slightly curved inwards. Frontal stripe deep yellowish brown, narrow and contracting below, about seven times as long as its widest part or about ten times as long as its narrowest part; frontal callus shining dark brown, long, narrow, not reaching the eyes with a linear extension, which extends on the lower two-thirds of the frontal stripe; pubescence on the frontal stripe short, upwardly curved and conspicuous black on all over but there are some short depressed inconspicuous yellowish grey hairs intermixed; vertex darker especially about the ocellar part (without any tubercle), densely covered with short black hairs which are slightly longer than those on the forehead. Frontal triangle brownish yellow and quite bare from pubescence, nearly flat, with a very fine longitudinal median sulcus and with two or three irregular oblique furrows on its each side. Face in colour similar to the frontal triangle, but covered with brownish black hairs almost all over; jowls in colour the same as face and clothed with abundant longer rather shaggy black hairs which do not extend up to the back of the head. Back of the head hollowed out but with a narrow unequal bare rim against the eyes which is deep orange yellow and is widest about the temple region, and behind which is an obvious though short yellowish brown ciliation, but this ciliation is interrupted at the vertex where there are some longer black hairs; absolute back of the head with soft yellow pubescence. Proboscis brownish black, rather short with comparatively long sucker-flaps which are furnished with long and short, blackish and paler hairs, the stalk bearing numerous blackish hairs on the hind margin. Palpi brownish yellow, long but not reaching to the apex of the proboscis; first joint rather small and more than one-thirds as long as the second joint, darker than the base of the following joint, and covered with very long black hairs; second

joint rather stout, abruptly bent soon after its base and thickest at the bend, after which the joint only gradually tapers to an obtuse point, almost four times as long as its broadest part and bearing all black short depressed bristles almost all over the surface except on more than the basal half of the inner face where it bears no pubescence or bristles. Antennae slender, yellowish red; first joint obscured by a yellowish grey tomentum, and bearing abundant short black bristly hairs which become longer at the lower apex and are wanting at the lower half of the inner side, about as long as its broadest part; second joint very small and about one-thirds as long as the basal joint, slightly obscured by a grey tomentum and bearing a complete apical circlet of short black bristles which grow slightly longer at the lower tip and become shorter and sparser at the innerside, the upper apical process somewhat conspicuous; third joint fully three and a half times as long as the basal two joints together, its basal annulation very slender and slightly broadened about the base where it has a rather short dorsal tooth crowned with some very short black bristles; style-like portion short and about one-thirds as long as the basal articulation of the joint, slightly darkened and with a short conical blackish apical annulation. Eyes unicolorous, in life bright coppery green, quite bare; facets all equally small; eyes in profile much deeper than long, the frontal margin slightly evenly curved forwards, the hind margin nearly straight but curved strongly about the lower end, the lower margin most curved below, and all the angles roundish; eyes when seen from in front about as wide as deep, with the frontal angle about 130° and the top angle less than 90°.

Thorax about as wide as long, nearly unicolorous but at the anterior part more yellowish and on the disc there are three rather fine inconspicuous brownish stripes, densely covered with nearly the same coloured tomentum as the face but slightly darker, and clothed with an abundant short depressed deep yellow (somewhat greyish) pubescence which grows slightly longer about the margins and which

is intermixed with numerous long but fine erect black hairs all over (not only at the shoulders and sides). Pleurae greyish dark brown, covered with numerous long (but still short) black hairs, which become denser and longer at the posterior half of the mesopleurae and at the anterior half of the pteropleurae, and which are mostly replaced by brownish yellow hairs at the large posterior half of the metapleurae; scutellum the same as the thorax, but the pubescence longer and denser.

Wings tinged brown but the base with some yellowish colour, and with the second submarginal cell and the large inner portion distinctly paler as they are nearly hyaline; upper branch of the cubital fork with no recurrent veinlet; first posterior cell widely open but more or less contracting at the margin; anal cell closed with a short petiole; discal cell moderate in size and slightly longer than the second posterior cell. Squamae in the alar pair grey, with a blackish margin and fringe; in the thoracal pair pale brownish yellow with a yellowish brown margin and a yellowish fringe; the long angle-tuft blackish and yellowish intermixed. Halteres brown with the extreme tip greyish.

Legs blackish, with the knees yellowish brown, and with all the tibiae whitish but their extreme apex more or less brownish or blackish; front coxae slightly covered with yellowish dark brown tomentum except on the lower and under parts, and clothed with numerous long somewhat shaggy blackish hairs; front femora covered with some dark brown tomentum and clothed with an abundant black pubescence leaving a rather narrow not hollowed out shining blackish bare subfemoral space, the pubescence growing longer and forming a rather conspicuous fringe at the outer side, and with a dense row of short black bristles on the inner margin of the bare space; middle and hind femora bearing short black pubescence which becomes longer beneath; front tibiae very slightly curved just below the middle, pale yellowish white with an apical fifth black, bearing dense very short

depressed snowy white pubescence which becomes black on the black part, and which is intermixed a very few inconspicuous short dark hairs on the upper side; middle tibiae only at the extreme tip brownish, densely covered with an abundant much shorter pure white pubescence but the tip there are some black hairs, and bearing two unequal brownish black apical spurs; hind tibiae the same as the middle pair but their pubescence slightly longer and their apical brownish portions slightly larger.

Abdomen about as long as the head and thorax (including the scutellum) together, slightly broader than the thorax, with the roundish apex, and rather flat. Dorsum deep brownish black with the sides of the first segment and the middle part just under the scutellum very faintly yellowish brown, covered with an abundant dense rather stout black pubescence, and some yellowish hairs, which appear on the yellowish brown parts of the first segment and on the middle part of the second segment, and on the middle line of the third segment there is a very few similar yellowish pubescence which is, however, not to be discerned, while the segmentations bear no yellowish hairs as Indian specimens have; belly blackish covered with some yellowish brown but somewhat shining, and covered with a dense short depressed black pubescence all over.

Length: 18.5 mm.

The species described above is very slightly different from Indian species, being much darker and bearing less yellowish pubescence on the abdomen, but it is quite identical with that. Only one female has been collected by Mr. M. Yoshino at Kusukusu in Koshun-Cho, May 21st, 1918, and it is known that the female is a blood-sucker against human being.

35. Tabanus perakiensis, Ricardo. (pl. VIII. fig. 7 ; pl. XI, figs. 15 & 16)

(Kuro—Abu)

Rec. Ind. Mus., IV, p. 204. 1911 ; Ann. Hist.-Nat. Mus. Nat. Hung., XI, p. 172, 1913.

A medium-sized but rather slender black species, with a long linear deep blackish castaneous frontal callus on the very norrow brownish frontal stripe, with the almost unicolorous blackish abdomen not banded, and with the blackish brown wings.

Female. Head broader than the thorax, moderately arched behind. Frontal stripe very narrow, gradually contracted from the vertex to the lower end, and wholly seven times as long as its broadest part or wholly thirteen times as long as its narrowest part, pale brown but the lower part slightly ashy greyish, covered with numerous very short inconspicuous black pubescence which becomes much sparse at just above the callus proper and then hardly extends below to the lower margin along its sides ; frontal callus shining deep blackish castaneous, long and narrow, not touching the eyes, wholly three times as long as wide, with the lower end rounded and with the upper top more or less notched and bearing a lineal prolongation which is about three times as long as the callus but its upper thirds is quite dusted though it is distinctly keeled, and which is not extending to the vertex ; vertex greyer, covered with numerous erect black pubescence which is slightly longer than that on the frontal stripe and is somewhat carved, and bearing very inconspicuous ocelli. Frontal triangle brownish yellow-grey, very slightly raised from the eye-margin below, with a very few but rather distinct entire median sulcus and with the more brownish tomentose double lunules just above the antennal fossae. Face grey tomentose but the upper corner of the cheeks yellowish brown, this colouring extending below along the eye-margins ; epistoma much broader than it is long, covered with some short but rather conspicuous blackish pubescence on the lateral upper corners

and about the middle except on the area just below the antennae; cheeks covered with numerous rather brownish black short pubeseence which grows up longer at the lower part and about the jowls on where there are numerous much longer more dense shaggy whitish soft hairs; back of the head moderately hollowed out all over, covered with a whitish grey tomentum and bearing numerous but not dense short white soft hairs; the postocular bare rim very pale yellowish white, very narrow and its upper thirds more narrow, behind which is a short rather dense conspicuous black ciliation which becomes slightly shorter and sparser below to the jowls. Palpi pale yellowish inside, but the outside covered with a dark grey tomentum; first joint about two-fifth as long as the second joint, blackish but moderately obscured by a grey tomentum and covered with numerous long not dense black pubescence; second joint rather slender, about three times as long as its broadest part, broadest about the base and then drooping and gradually narrowed to an obtuse point, covered with numerous dense depressed black bristles all over the outside, while the inside is quite bare, and on the underside of the base there are some longer but black hairs. Antennae dull reddish brown with the basal joint somewhat yellowish; basal joint slightly thickened apically above at the top hooked over the base of the second joint, longer than its stoutest part, covered with numerous short black pubescence which becomes conspicuously sparser about the upper and inner bases, while at the lower tip there are some conspicuous longer black hairs and on the outside rather numerous less longer similar hairs almost all over; second joint very small and about one-thirds as long as the basal joint, with the moderately long narrow black apical process as usual and with a complete apical circlet of short black bristles which on the underside slightly longer but less denser, and that on the sides especially on the inner side become much denser; the basal annulation of the third joint narrow and long, about twice as long as the two basal joints together, about three times as long as its broadest part,

and near the base with a very small tooth which is crowned with two or three tiny black bristles, its ventral margin very slightly bent below before the middle of the length; style-like portion (incomplete) darker. Eyes bare, with the facets all equal in size, in death deep purplish black; when seen from above the hind margin nearly straight and slightly longer than the frontal margin, the outer margin moderately convex evenly, the top angle about 105° and the frontal angle 60°; in profile elongate-oval with the angles all rounded, the frontal and hind margins rather conspicuously convex and the lower margin strongly curved below; when seen from in front about as wide as deep, the facial margin very slightly convex and slightly shorter than the frontal angle about 145°, the top angle about 85°, and the lower angle about 110°.

Thorax rather small, somewhat roundish but slightly longer than width, brownish black, slightly obscured by a greyish tomentum, and with some traces of appressed short pale hairs especially about the suture, the pubescence numerous short and black; humeri lighter and bearing rather numerous long whitish grey pubescence; praealar calli more blackish, covered with numerous long black pubescence which becomes conspicuously shorter and sparser at about the upper half on where there are some short recumbent shining whitish hairs intermixed; postalar calli more brownish, covered with short black and pale hairs, and at the postero-outer margin there is a dense slightly long pale fringe, the similar but shorter and less conspicuous one at near the upper wing-base; pleurae conspicuously obscured by a grey tomentum and covered with numerous short (but longer than that on the thorax) whitish soft pubescence which becomes blackish, much longer, and more conspicuous on about the posterior half of the mesopleurae, and the pubescence on the prothorax and the fringe on the meso-, ptero-, and meta-pleurae are dull whitish and conspicuously long. Scutellum the same as the thorax but less brownish and bearing short paler fringe.

Wings shorter than the thorax and abdomen together, deeply infumate but paler on the posterior part and at the extreme apex, and somewhat paler about the centres of cells, with the veins and stigma blackish brown but some veins partly or wholly more blackish; costal cell somewhat tinged with yellowish, posterior cells all widely open, discal cell moderate in size and apparently longer than the first posterior cell, and the anal cell closed with a somewhat long petiole; upper branch of the cubital fork without the recurrent veinlet. Squamae in the alar pair dark grey with a conspicuous blackish brown margin and a rather conspicuous dark brown fringe of rather stout and dense short pubescence, excepting of dense moderately long whitish tuft about the angle; in the thoracal pairs yellowish brown with a comparatively broad brown margin and with a less conspicuous and dense, brownish ciliation.

Legs blackish with the extreme tip of the femora and the tibiae reddish yellow; front coxae densely covered with a grey tomentum and bearing abundant long whitish soft pubescence which becomes short towards the apex at where there are some short stout black hairs on the outer side; front femora, tibiae and tarsi wanting, but according to Miss Ricardo's description the tibiae at the basal half reddish yellow; middle femora slightly covered with a greyish dust, bearing numerous short black pubescence which is more or less intermixed with pale hairs, and on the underside there is a rather long conspicuous fringe composed of whitish and black hairs; hind femora haired as in the middle pair, but all the hairs rather longer especially on the dorsal margin; middle tibiae gradually but slightly darkened towards the tip, covered with abundant rather dense short depressed black pubescence, and bearing two unequal blackish apical spurs; hind tibiae haired as in the preceding pair, but bearing two rather conspicuous short black dorsal fringes; posterior two pairs of tarsi brownish black, covered with dense short depressed black bristles, and their soles not paler; claws shining black with the extreme base rather reddish brown; pulvilli dull orange yellow.

Abdomen narrow and long but broader than the thorax and gradually narrowed to a rather rounded apex; brownish black unicolorous, slightly covered with a greyish tomentum and clothed with a close-lying short black pubescence, and at the sides there are longer black hairs which on the basal three segments are whitish, these pale hairs somewhat extending behind to the fourth segment; underside more blackish but obscured by a greyish tomentum, with the very narrow whitish haired segmentations which do not appear on the first, sixth and seventh segments, the pubescence on the rest black as that on the dorsum.

Length: 16 mm.

I described above from only a single specimen from Kosempo, which has been compared with the type in the British Museum.

This species is very uncommon in Formosa as it is only recorded from Fuhosho (July) and Kosempo (July), and it is unknown if the female has a biting habit. This species also is known to occur in the Federate Malay States.

T. perakiensis is easily distinguished from all the other of our *Tabanus* fauna, by its slender form, its infumated wings, its unicolorous brownish black abdomen, and its blackish brown thorax without stripes, while it is allied to *T. inobservatus*, Ricardo, from Sumatra but quite different, as Miss Ricardo pointed out in her Revision.

36. Tabanus formosiensis, Ricardo. (pl. VIII, fig. 6; pl. XI, fig. 17).

(Ki-ashi-Chibi-Abu)

Rec. Ind. Mus., IV, p. 220. 1911; Ann. Hist.-Nat. Mus. Nat. Hung., XI, p. 172, 1913.

A small blackish grey species with a small cylindrical frontal callus having a very narrow and very long linear extension on the narrow frontal stripe, with the antennae and legs pale yellow, with the quite clear wings, and with the abdomen tinged with some olive-grey.

Female. Head comparatively large, about a half as long as the thorax but broader, moderately arched behind. Frontal stripe yellowish brown, narrow, gradually contracting from the vertex to the lower end, and about six times as long as its broadest part or wholly ten times as long as its narrowest part, covered with numerous but not very dense short black pubescence which becomes slightly sparser below; frontal callus shining black, cylindrical, about three times as long as it is broad, with the very narrow shining black extension which is wholly two and a half times as long as the callus proper and extends to the upper end of the lower two-thirds of the frontal stripe, the callus proper well separated from the eye-margin by the comparatively broad linear intervals; vertex slightly more greyish than the forehead, covered with much abundant similar black pubescence, behind which is some longer stouter black outstanding hairs. Frontal triangle yellowish brown tomentose, but slightly paler at the lower lateral corners, moderately convex, with a fine but distinct median sulcus throughout, and with the somewhat paler double lunules just above the antennal fossae. Face moderately raised from the eye-margins, covered with a whitish tomentum but the upper corners of the cheeks conspicuously dusted with yellow, the colour slightly extending below along the eye-margins; epistoma about as long as wide, bearing some short silvery white pubescence on about the lower half or more, intermixed with very few sparse stout rather conspicuous black hairs, some similar but longer (though less inconspicuous) black hairs on about the upper lateral corners; lateral pits rather narrow and long, not very deep; cheeks at the lower part about a half as wide as the epistoma, covered with numerous dense short (but slightly longer than that on the middle part of the epistoma) black pubescence which becomes sparser near the epistoma and at the lower part where are numerous longer though fine silvery white soft hairs which extend on the jowls and grow longer and shaggy there; back of the head covered with a white dust and rather sparser silvery white soft pubescence, shallow on the lower part

and hollowed out above, with the narrow but comparatively rather broad greyish white tomentose postocular bare rim which is the same in width nearly throughout but at the temple region more or less narrowed, behind which is a short pale yellowish grey ciliation. Proboscis brownish yellow, about two-thirds as long as the depth of the head; stalk covered with abundant but not dense rather long pale hairs behind; sucker-flaps large, longer than the stalk, furnished with brownish bristly hairs scattered all over the lower surface. Palpi yellowish white; basal joint somewhat greyish, about one-thirds as long as the second joint, covered with abundant long silvery white soft hairs which are intermixed with some similarly long blackish ones about the tip of the outerside; end joint about four times as long as its broadest part, broad at about the basal half and then slightly drooping and gradually narrowed to a rather sharp point, clothed with numerous tiny depressed black bristles which do not extend on the extreme base at where there is a very few inconspicuous white pubescence, and before this part there are some longer black hairs beneath, the inside quite bare. Antennae yellow; first joint very short and as long as its broadest part, with the apex very slightly hooked above over the base of the second joint, covered with numerous tiny black pubescence which does not entirely extend towards the underside; second joint not very small and about a half as long as the basal joint, with a comparatively long narrow upper process at the apex, and with an incomplete apical circlet of tiny black bristles; third joint reddish yellow, near the base with a very small but distinct tooth crowned with a few inconspicuous black pubescence, narrow, not very wide at the base, with the style-like portion slightly darker. Eyes rather large, bare, with the facets all equal, in death coppery black; when seen from above the hind margin straight and longer than the frontal margin, the outer margin almost evenly convex, the top angle about 105° and the frontal angle about 65°; in profile irregular oval, apparently deeper than long, with the angles all roundish excepting of the frontal one about 150°, the frontal

margin moderately convex especially at the upper thirds; when seen from in front about as wide as deep, the facial margin very slightly convex and shorter than the frontal margin, the top angle about 90°, and the frontal angle about 135°.

Thorax longer than the width, with the rounded angles, blackish, obscured by a yellowish grey tomentum which becomes somewhat whitish anteriorly, covered with numerous short depressed yellow pubescence which is intermixed with scattered erect still short black hairs which do not extend at the vertical part at where there are some whitish soft hairs; humeri somewhat reddish but quite obscured by a greyish white dust, and covered with abundant long pale pubescence but on about the postero-upper half there are some shorter black hairs; praealar calli somewhat brownish below, covered with numerous short recumbent yellow pubescence intermixed with some slightly longer black stout hairs, and on the lower half is a not dense though broad black fringe of numerous long erect hairs; postalar calli not conspicuous, haired as disc but at the outer margin there is a somewhat conspicuous pale brownish fringe, the similar but less conspicuous and less long one about the upper wing-bases; pleurae obscured by a whitish tomentum and bearing abundant silvery white soft hairs which on about the upper part of the mesopleurae grow up longer and become slightly yellowish, and on the postero-upper margin a long conspicuous pale yellowish grey fringe, on the upper margin of the ptero- and meta-pleurae similar but greyish fringe, and on the prothorax there are numerous much long white hairs. Scutellum as thorax, but the pubescence all longer and more conspicuous, and with a rather inconspicuous pale brownish yellow fringe on the margin.

Wings shorter than the thorax and abdomen together, quite clear, with the stigma and veins pale yellow but the costal and discal veins conspicuously brownish; posterior cells all widely open, discal cell comparatively small and shorter than the first posterior cell, and anal cell closed with a long petiole; upper branch of the cubital fork with-

out the recurrent veinlet. Squamae in the alar pair pale grey with a blackish brown margin and a very short but somewhat conspicuous dark brown fringe excepting of the yellowish tuft about the angle; in the thoracal pair very pale yellowish grey with a pale brownish yellow margin and a whitish inconspicuous (but longer than that on the alar pair) fringe. Halteres yellow but the upper surface of the knob more or less brown tinged.

Legs pale dull yellow, with the coxae blackish, with the basal part of the hind femora more or less blackish and with the front tarsi blackish brown; front coxae quite obscured by a white tomentum, and bearing numerous long silvery long pubescence which on the upperside very slightly tinged with yellowish grey, and which becomes shorter apically; front femora about the base of the underside more or less brownish, obscured by a whitish tomentum leaving the rather broad shining yellow subfemoral bare space which is hollowed out at the apical half but not conspicuously striolate, on the innermargin of this bare space a rather conspicuous ciliation composed of short black bristles, the innerside covered with numerous very tiny black depressed pubescence and the outer side clothed with numerous long rather erect black hairs which is intermixed with some similar but whitish hairs nearly throughout the length; middle femora slightly blackish about the base of the underside, and obscured by a whitish tomentum, bearing abundant white pubescence which becomes longer on about the under half, and on about the apex of the upperside there are some tiny scattered black hairs; hind femora also obscured by a whitish dust, and covered with numerous short white pubescence which slightly grows longer on the underside but not conspicuous as in the middle pair; front tibiae at the apical part brownish and covered with a tiny black depressed pubescence there, the pubescence on the rest almost all white but along the upper margin with some scattered black hairs intermixed; posterior two pairs of tibiae covered with a tiny whitish depressed pubescence almost all over but on the dorsal half or less

there are numerous short sloping black hairs which on the hind pair are somewhat forming a conspicuous outer dorsal fringe, the spurs on the middle pair comparatively large, unequal, and brown with the tips black; tarsi all clothed with very tiny dense depressed black bristles but on the basal half or more of the first joint there are very short yellowish hairs especially on the middle pair conspicuous; the claws black with the base reddish brown, the pulvilli dull yellow.

Abdomen slightly longer than the head and thorax (including the scutellum) together, and about the base slightly broader than the latter, gradually narrowed to the broad flat end. Dorsum olive-brown, covered with a yellowish brown tomentum and with an abundant short depressed conspicuous yellow pubescence which is intermixed with numerous sloping short less conspicuous black hairs, on the white tomentose sides of the first two segments there are some long erect conspicuous whitish hairs which becomes shorter on the second segment. Underside black, obscured by a whitish tomentum which becomes yellowish brown grey on the posterior segments, with the very narrow yellowish segmentations except on the first and seventh segments, the similar segmentations appearing on the sides of the dorsum, with a very tiny whitish appressed pubescence but on about the middle part numerous thin inconspicuous longer brownish grey hairs, while on the apical two segments there are abundant much longer conspicuous black hairs which somewhat extend up to the fourth segment about the middle part only, and which on the seventh segment are almost entirely replaced by erect curved stout bristly hairs.

Length: 11 mm.

This species is easily distinguished from any other Formosan or Japanese *Tabanus*, by the yellow legs, the clear wings, the greyish black thorax, the olive-brown abdomen, and the frontal callus with a very narrow lineal extension on the very narrow frontal stripe; on the other hand, it quite differs from the allied species, *T. subkirtus*, Ricardo,

from Java, as Miss Ricardo pointed out in the Record of Indian Museum Vol. IV, p. 220.

T. formosiensis is one of most rare species in Formosa, and at the present time its occurence is quite restricted, as I have a record only from Takao, from May to July 19th. It is not known whether this fly is a real biting species or not.

VI. **Isshikia**, n. gen.

Head wider than the thorax, rather short; frontal stripe narrow, with a long frontal callus and without ocelligerous tubercle; frontal triangle not shining covered with tomentum; face moderately convex, with rather short pubescence; eyes very inconspicuously pubescent, with facets almost all equal and with a conspicuous though narrow shining frontal margin where the facets do not appear. Antennae about as long as the head; two basal joints short, and the second one with a rather long process above the apical margin; the third long, composed of distinct five annulations. the basal annulation with an unusually long basal process which is quite the same as in the genus *Dichoelacera* but not quite reaching the apex of the basal annulation, and the style is rather stout but very short (about half as long as the basal annulation). Proboscis powerful, produced, and bearing rather large sucker-flaps. Palpi very conspicuous, two-jointed, with the apical joint cylindrical and drooping to a point, lying on the proboscis and mainly clothed with small depressed bristles; basal joint short ovate and bearing long pubescence.

Thorax moderate in size, quadrate with rounded angles; humeri distinct; praealar calli large, triangular. Pubescence fairly abundant especially towards the sides; pleurae conspicuously pubescent on the upper hind part of the mesopleurae and on the prothorax, metapleurae and pteropleurae, but there is no trace of bristles anywhere on the pleurae though the praealar calli bear conspicuous bristles about the lower margin.

Wings without any markings; but rippled all over, practically glabrous. Venation quite in accordance with the usual type of *Tabanus*; the four posterior cells wide open; anal cell closed long before the wing-margin; the upper branch of the cubital fork without the recurrent veinlet. Alulae strongly developed, and so large that when the wings are at rest they are pushed upright against the sides of the scutellum. Squamae very well developed, and with darkened margins which bear a short ciliation except on the alar pair near the angle where there is a conspicuous tuft of long hairs; thoracal pair largest but not concealed the halteres which are moderate.

Legs simple, but with two rather unequal spurs on the middle tibiae; front coxae long, being about two-thirds as long as the femora; hind tibiae somewhat ciliated; femora slightly shorter than the tibiae, clothed with soft pubescence except along the underside of the front femora and on a streak behind the apical quarter of the hind femora, these parts being bare from pubescence but not conspicuously shining; the bare part of the underside of the front femora minutely transversely striolate and margined with conspicuous bristles at the inner side; front tibiae about the tip and the front tarsi beneath or about the sides with peculiar touch-hairs, which are analogous to those in the genus *Tabanus*.

Abdomen slightly broader and conspicuously longer than the thorax, rather flattened; pubescence on the surface short and inconspicuous; but the ventre bears rather conspicuous bristly hairs on the posterior segments.

This new genus is formed from a species, from Yamato, very like a *Tabanus* species in appearance, but distinguished from any species of *Tabanus* by its considerably long process of the basal annulation of the third antennal joint; it is also distinguished from any species of *Dichoelacera* by its wings without any markings. Although the eyes are not distinctly hairy, the type of this genus should be identified with *Dichoelacera japonica*, Bigot, as the character that the eyes bear pubescence, in many cases, is not valid. Miss Ricardo suggests *D. japonica*

may possibly belong to the subgenus *Atylotus* as it has hairy eyes, but this species, determined by me, has no Atylotus-like appearance.

1. Isshikia japonica, Bigot. (pl. II, fig. 9; pl. IX, figs. 13 & 14).

(Higenaga—Sashi—Abu, or Isshiki—Abu)

Dichoelacera japonica, Bigot, Mem. Soc. Zool. France, V, p. 632, 1892.
Matsumura, 大日本害蟲全書, 後編, p. 70, 1914.

Tabanus japonicus, Ricardo, Ann. Mag. Nat. Hist., (7), XIV, p. 368, 1904; Rec. Ind. Mus., IV, p. 241, 1911 (*Atylotus*?).
Kertesz, Cat. Dipt., III, p. 252, 1908.

Female. Head conspicuously wider than the thorax, slightly arched and rather short. Frontal stripe greyish yellow but becoming more brownish orange about the lower half, narrow, distinctly contracting from the upper part down to the front eye-angles, and nearly nine times as long as its narrowest part or about four and a half times as long as its widest part; frontal triangle slightly elevated, black but entirely obscured by a greyish dust, with rather broad somewhat hollowed out double lunules which are distinctly dusted with yellowish, in the middle there is a narrow longitudinal furrow which extends from the frontal callus to the interval space between the antennae, and this furrow is inconspicuous on the ridge between the lunules just above the antennae; frontal callus shining black long and very narrow, slightly but conspicuously elevated, expanding about lower two-thirds of the frontal stripe and its width occupying about the middle thirds but the lower part slightly broader so that the callus occupies about the middle three-fifth of the width, the both ends of the callus inconspicuously separated by a fine longitudinal furrow; pubescence on the frontal stripe rather sparse, short, blackish brown intermixed with a few yellowish white hairs which are more short and more depressed, the blackish one is sloping forwards but some backwards, while on the vertex the pubescence is somewhat longer, and stouter, curved forwards and all blackish,

which extends at the occiput. Face greyish yellow. on the cheeks there is rather sparse, short, whitish yellow pubescence which becomes longer and denser all over the jowls, while the epistoma almost is bare though on the upper and side parts there is very inconspicuous short pubescence; jowls moderately broad and puffed out below, yellowish grey, and with a bare greyish white postocular rim extending from them up to the top corners of the eyes, and this rim contracting from the jowls to the vertex; immediately behind this postocular rim a short brown ciliation exists which slightly increases in width from the upper to lower part, but so slightly that it is not visible when the head is viewed from in front; this ciliation not merged into the curved black hairs on the occiput; back of the head slightly hollowed out, yellowish grey, with rather a few scattered pale pubescence which becomes somewhat conspicuous below to the jowls. Proboscis not very stout, about two-thirds as long as the depth of the head, pale brown, its stalk bearing somewhat long, erect, yellowish hairs behind, the sucker-flaps about half as long as the proboscis, and bearing rather sparse rather short yellowish pubescence beneath, palpi slender dull yellow, slightly shorter than the antennae; basal joint narrow, cylindrical, about one-thirds as long as the second joint, slightly greyish at the outside, bearing abundant long pale yellowish hairs which only extend about the outside and lower surface, and which are intermixed with a few black bristly hairs about the apex; second joint fairly stout for about the basal half and thence steadily contracting to a sharp point, about four times as long as its thickest part, and clothed with numerous short depressed black bristles all over the upper and outer parts except just the base, and with a few thin pale hairs beneath the basal half intermixed, and at the inner side there are a few scattered similar bristles about the apical thirds. Antennae more or less brownish red with the style-like portion blackish, but the two basal somewhat greyish orange; basal joint on the upper part with dense short black bristles which somewhat extend below to the side parts except the narrow

lower part; second joint very short about one-thirds as long as the first joint, with a conspicuous rather long process on the upper apex, and with a circlet of short black bristles and without any pale pubescence; third joint (without the style-like portion) more than one and a half times as long as the depth of the broadest part; the dorsal process well before the middle, slender, reaching the apex of the basal annulation of the third joint, and curved above and then below, as that in *Dichoelacera*, furnished with tiny black britsles at the tip, the bristles extending more than two-thirds of the process along the dorsal margin; style-like portion shorter than two-thirds of the basal annulation and also apparently shorter than the dorsal process, composed of four annulations about equal in length, each annulation bearing one or two short blackish bristly hairs at the dorsal apex, the apical annulation being somewhat longer than the others and conical. Eyes practically bare, in profile oval and about three-fifths as long as the depth, when seen from front about as wide as the depth and the blunt angle between the inner and lower margins being about 135°; in death deep purplish black, without any band or marking.

Thorax quadrate with rounded angles, greyish black, with two very faint narrow greyish dorsal stripes and broad similar lateral stripes; the dorsal stripes fused together after the suture and between which much more faint very narrow middle stripe exists on the anterior half, the lateral stripes not quite extend to the hindmargin but end in a point; humeri distinctly ashy grey with slight yellowish tinge, praealar calli quite ashy grey, and postalar calli obscurely brownish. Pubescence composed of fairly numerous but not conspicuous erect black hairs all over except on the front part at where they are longer and denser though pale, and numerous sloping or depressed thin yellow hairs occur intermixed among the erect black hairs but are easily abraded and leave only traces of their existence, these yellow hairs becoming denser and longer at the side of the disc; praealar calli with rather long scattered black bristly hairs, and with depressed yellow one

at the upper-hind part; postalar calli with erect blackish hairs intermixed with numerous depressed yellow hairs; pleurae greyish, with all whitish pubescence which is dense and wholly except on the lower part, on the hind margin of the mesopleurae and on the metapleurae there is a long tuft of dense yellowish hairs; between the notum and pleurae there is a distinct reddish brown ridge which extends from the hind corner of the humeral callus to just after middle of the lower margin of praealar callus and which is bent downwards at just below the anterior corner of the praealar callus and bears a few pale depressed hairs. Scutellum with erect brownish yellow hairs intermixed with conspicuous rather numerous depressed yellow hairs all over the disc, but with a fringe of equally long yellowish hairs about the margin.

Wings about as long as the thorax and abdomen together, slightly brownish, hyaline, with the costal and subcostal cells and the extreme base of the wing light yellow; the narrow brownish stigma formed by the swollen end of the subcostal vein, the lower margin of the stigma being yellow; veins brown but the basal portion yellowish. Squamae in the alar pair glassy white with a brown margin and with a short brown fringe which grows into the yellow long tuft about the angle; in the thoracal pair pale yellowish, with a yellowish brown margin, and with a very short whitish fringe. Halteres dull yellowish brown with blackish knob which is slightly yellowish at the extreme top.

Legs dull greyish black, but dull orange on the extreme tip of the femora, more than the basal half of the front tibiae, all the posterior tibiae except the tip, and the base of the posterior tarsi; front coxae ashy grey, with long greyish white rather abundant pubescence, which becomes shorter towards the apex and becomes yellowish on the dorsal apical half; pubescence on the front femora long and greyish yellow about the base of the upper side and all about the outer side, but black and short on the rest of the upper side, with the underside somewhat shining blackish and bare subfemoral space and with a dense row of

minute black bristles on the anterior margin of the bare space ; on the middle femora shorter and less conspicuous and almost all deep yellow and sloping but on the underside there is more erect paler and longer pubescence ; on the hind femora dense longer and deep yellow outerventrally ; front tibiae with short depressed bristles which are mainly black but intermixed with a few deep yellow bristles about the basal half, while the middle tibiae have mainly yellow bristles and are intermixed with a few black bristles throughout the upper side and about the apical fourth ; hind tibiae with the upper and lower ciliations in which the upper one is composed of yellow and a few black hairs, clothed with yellow pubescence more than the basal half, and bear two black dorsal ciliations and a yellow ventral one ; the spurs on the middle tibiae stout but short, unequal, reddish brown with blackish tip ; front tarsi with rather conspicuous touch-hairs. Pulvilli pale brown ; claws large, black with reddish brown base.

Abdomen large, longer than the head and thorax (including the scutellum) together, reddish brown with the last three segments blackish. Dorsum with a faint brown irregular spot about the middle of the basal segment, with the rather broad yellow posterior marginal band on each segment from the basal to fourth segments, on the yellow bands there is yellowish depressed pubescence and on the rest there is mainly brownish black pubescence, the three posterior segments almost entire covered with slightly longer black pubescence but the fifth segment with a very narrow yellowish posterior margin where the yellow pubescence occurs, the side fringe somewhat long and composed of yellowish hairs but this fringe does not extend on the two apical segments ; ventre with rather narrow yellowish posterior marginal band on each segment from the first to fifth segments, pubescence much shorter and almost all yellow but on the three apical segments there are longer somewhat bristly black hairs, the similar but fine very few black pubescence on the middle part of both the third and fourth segments occurs.

Length: 15 mm.

This species well agrees to Bigot's description of *D. japonica*, I took, therefore, this name. The above description is made from a single specimen collected by Dr. T. Isshiki, at Odaigahara-Yama, in Yamato, on the 11th. of August, 1913. The habit is not known to me.

THE END

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clausacella ..... 312.
coquilletti..... 192,392.
cordiger ..... 189,207.
CORIZONEURA..... 8,17.
crassus ..... 191,330.

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dispar ..... 53.
distinguendus ..... 124,150.
dorsalis ..... 12,14.

E.

exoticus ..... 192,371.

F.

formosana .. ..92,109.
formosiensis ..... 11,12,192,429.
fulvicinctus ..... 189,246.
fulvimedius ..... 192,399.
fulvimedioides..... 189,219.
fulvus ..... 162,163.
fuscicornis ..... 191,335.

H.

HAEMATOPOTA ..... 9,88.

P.

hirticeps ..... 124,131.

humilis..... 190,258.

I.

impar ..... 36.

indianus ..... 191,284.

iranensis ..... 25.

ISSHIKIA ..... 9,435.

iyoensis ..... 190,251.

J.

japonica ..... 25,83,437.

K.

karafutonis ..... 125.

komurae ..... 131.

kotoshoensis ..... 189,193.

L.

lateralis ..... 322.

latifrons ..... 208.

ligatus ..... 35.

lunatus ..... 35.

luridus..... 139,258.

M.

mandarinus ..... 191,301.

megacephalus ..... 209.

melanopygatus..... 399.

miyajima ..... 191,351.

miyakei ..... 190,273.

mlokosiewiczi ..... 24,25.

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nigricornis ..... 25,77.

O. P.

okadae ..... 312.

okinawanus ..... 190,277.

P.

paganus ..... 138.

pagodinus ..... 399.

pallidipectoratus ..... 192,418.

Pangoninae ..... 9,8.

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pyrrhoceras ..... 407.

pyrrhus ..... 164,180.

Q.

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R.

rousselii ..... 175.

rufidens ..... 192,382.

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rufipennis ..... 92,118.

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S.

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sakhalinensis ..... 25,75,92,104.

sanguineus ..... 191,343.

sanguisorba..... 164.

sapporoensis ..... 189,202.

sapporoenus..... 191,295.

sauteri..... 191,337.

semicirculus ..... 36.

sexcinctus..... 190,234.

signatipennis ..... 312.

signatus ..... 139.

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terminalis ..... 36.
trandinus..... 125.
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trigonus ..... 371.
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tropicus..... 124,137.
tropicus ..... 150.

V.

vicinus..... 208.

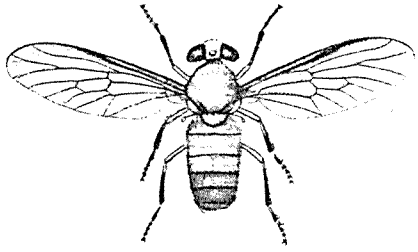
Y.

yezoensis ..... 19.
yokoamensis ..... 302.

Explanation of Plate I.

1. Silvius formosiensis Ric.
2. Silvius dorsalis Coq.
3. Chrysops nilokosiewiczi Big.
4. Chrysops dispar Fab.
5. Chrysops sinensis Walk.
6. Chrysops sinensis Walk. (♂)
7. Chrysops suavis Loew.
8. Chrysops suavis Loew. (♂)

PLATE I



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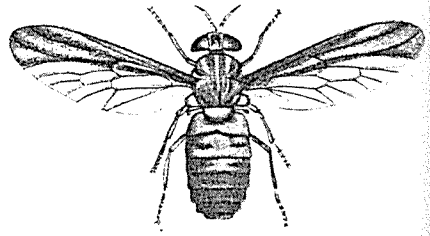

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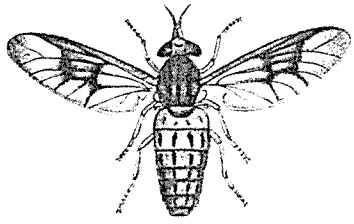

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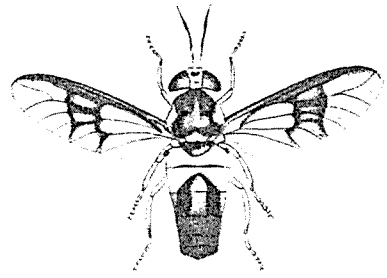

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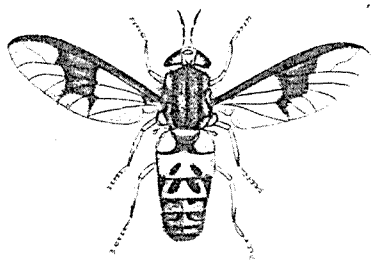

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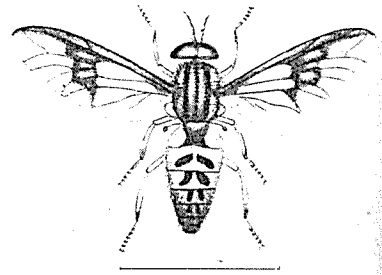

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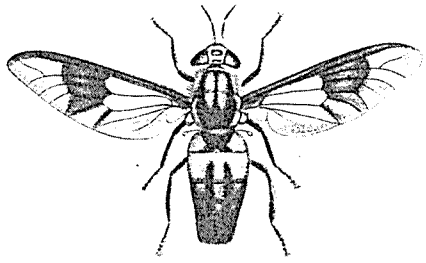

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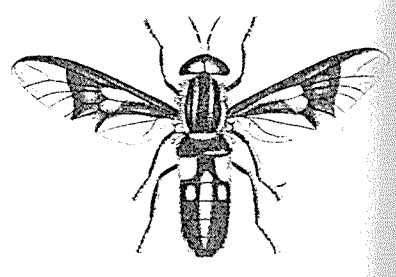

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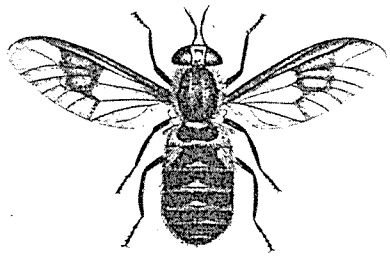
Explanation of Plate II.

1. Chrysops nigricornis Mats.
2. Chrysops basalis Shir.
3. Chrysops basalis Shir. (♂)
4. Chrysops japonicus Wied.
5. Chrysops japonicus Wied. (♂)
6. Haematopota formosana Shir.
7. Haematopota tristis Big.
8. Haematopota sakhalinensis Shir. (♂)
9. Isshikia japonica Big.

PLATE II



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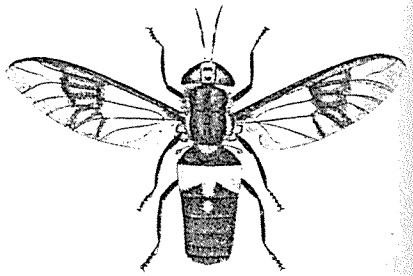

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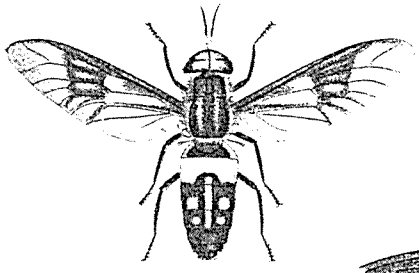

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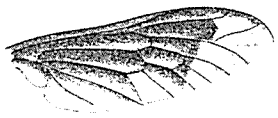

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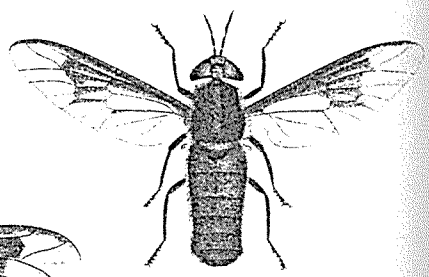

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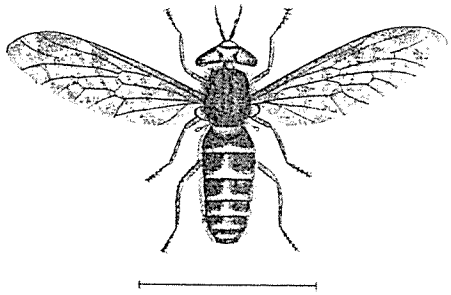

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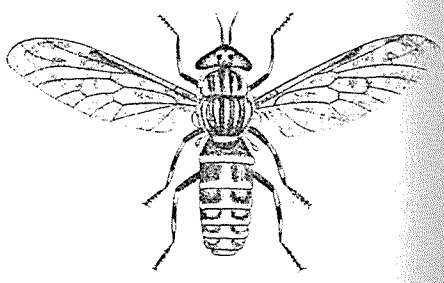

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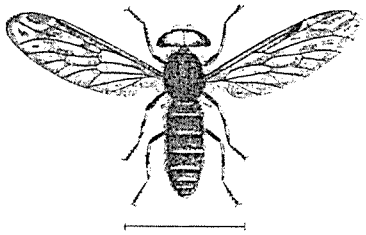

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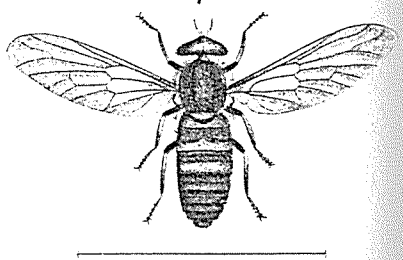

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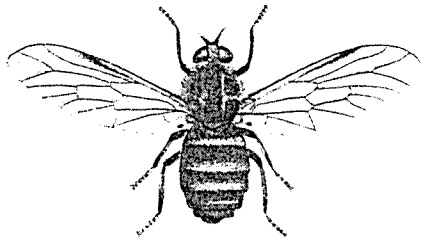
Explanation of Plate III.

1. Corizoneura yezoensis Shir.
2. Therioplectes tarandinus L.
3. Therioplectes hirticeps Loew.
4. Therioplectes tropicus Panz.
5. Therioplectes tropicus Panz. (♂)
6. Therioplectes distinguendus Verr.
7. Therioplectes distinguendus Verr. (♂)
8. Atylotus rusticus Fab.

PLATE Ⅲ



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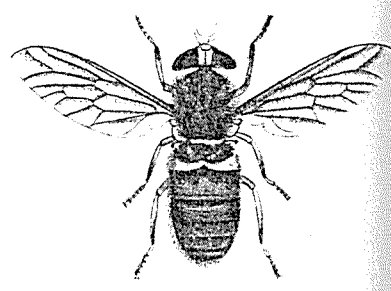

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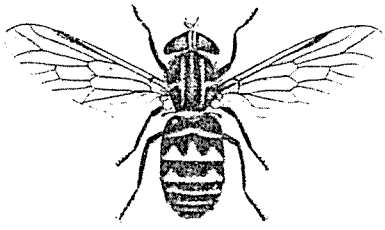

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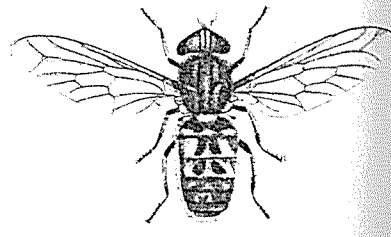

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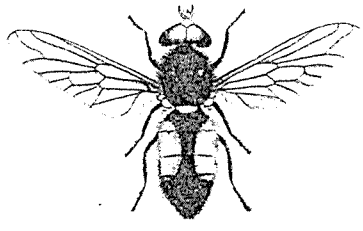

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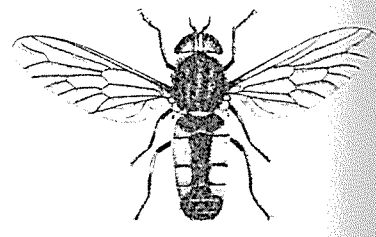

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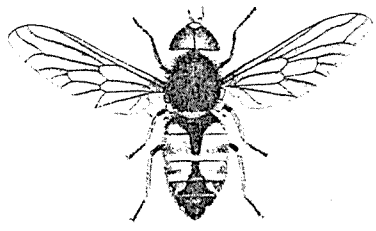

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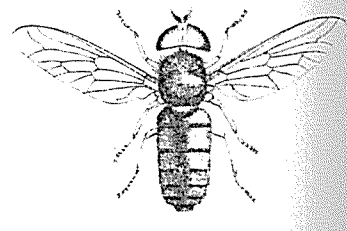

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Explanation of Plate IV.

Fig. 1. Atylotus bivittatus Mats.

2. Atylotus bivittatus Mats. (♂)

3. Atylotus fulvus Meig.

4. Atylotus fulvus Meig. (♂)

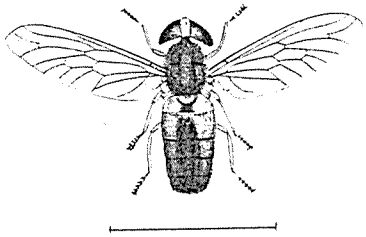
5. Tabanus kotoshoensis Shir. (n. sp.)

6. Tabanus arisanus Shir. (n. sp.)

7. Tabanus sapporoensis Shir. (n. sp.)

8. Tabanus fulvicinctus Ric.

PLATE IV



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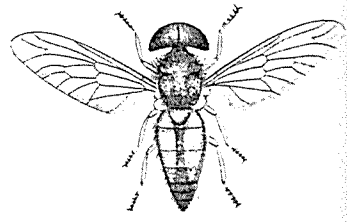

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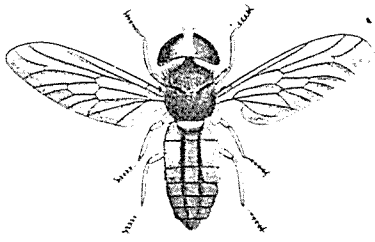

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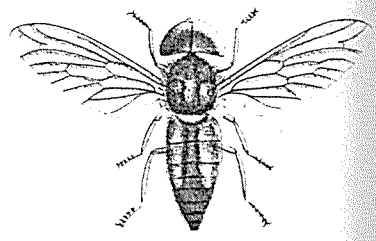

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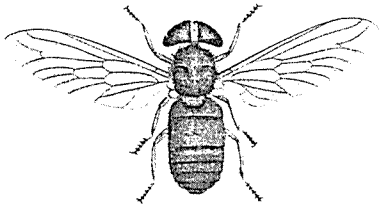

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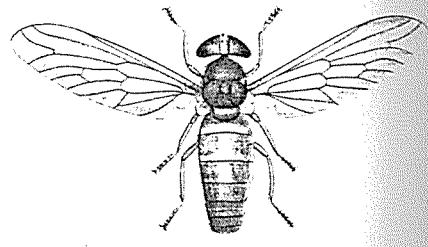

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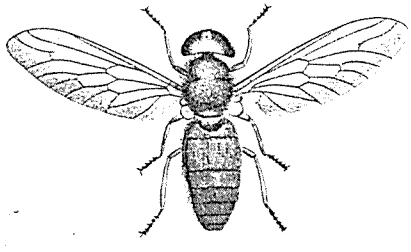

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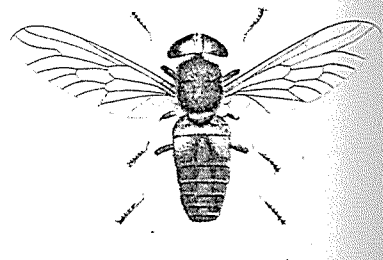

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Explanation of Plate V.

Fig. 1. Tabanus quinquecinctus Ric.

2. Tabanus sexcinctus Ric.

3. Tabanus bicinctus Ric.

4. Tabanus iyoensis Shir. (n. sp.)

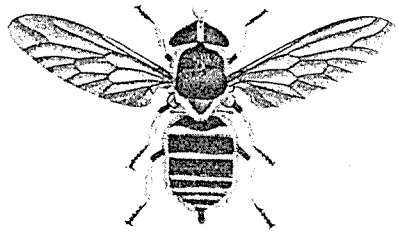
5. Tabanus humilis Coq.

6. Tabanus cordiger Meig.

7. Tabanus cordiger Meig. (♂)

8. Tabanus fulvimedioides Shir. (n. sp.)

PLATE V



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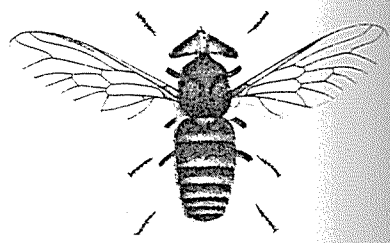

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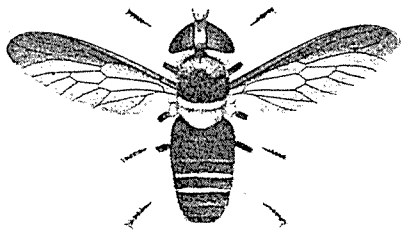

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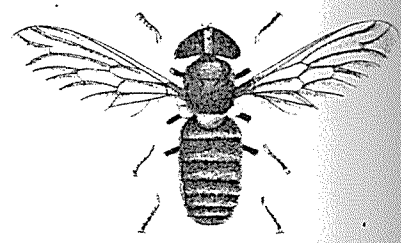

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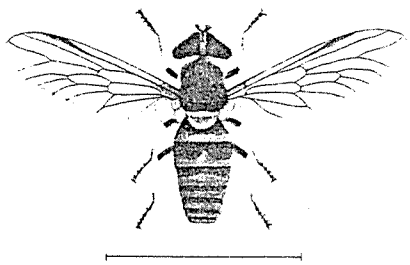

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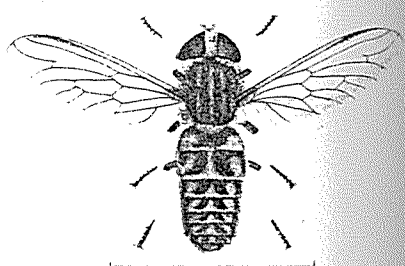

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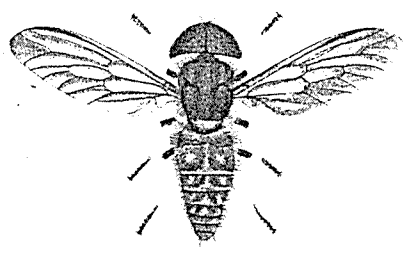

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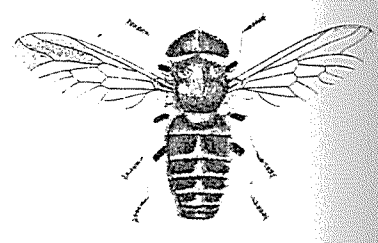

8

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Litho. : Printer Hayaisha, Tokyo, Japan

Explanation of Plate VI.

Fig. 1. Tabanus indianus Ric.

2. Tabanus miyakei Shir. (n. sp.)

3. Tabanus okinawanus Shir. (n. sp.)

4. Tabanus mandarinus Schin.

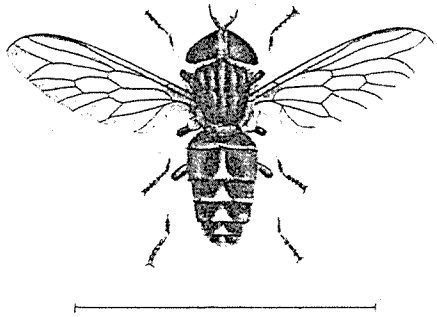
5. Tabanus mandarinus Schin. (♂)

6. Tabanus amaenus Walk.

7. Tabanus amaenus lateralis Shir. (n. sp.)

8. Tabanus amaenus lateralis Shir. (♂) (n. sp.)

PLATE VI



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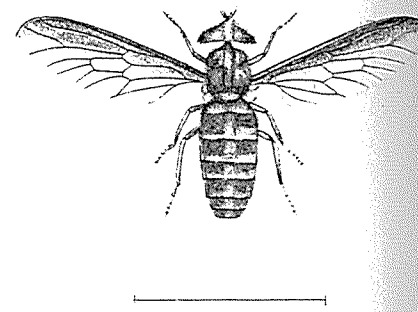

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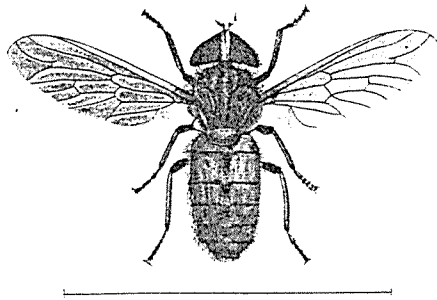

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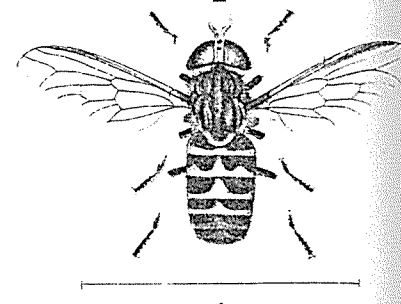

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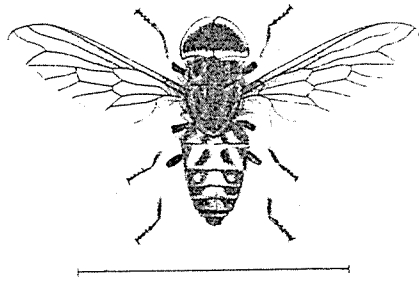

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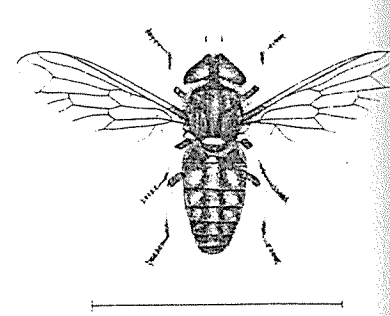

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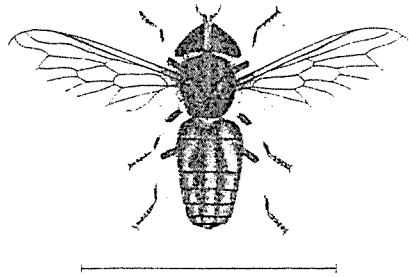

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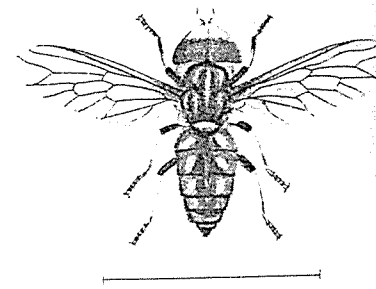

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I. Okuni del.

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Explanation of Plate VII.

Fig. 1. Tabanus abbreviatus Big.

2. Tabanus takasagoensis Shir. (n. sp.)

3. Tabanus sapporoenus Shir. (n. sp.)

4. Tabanus sauteri Ric.

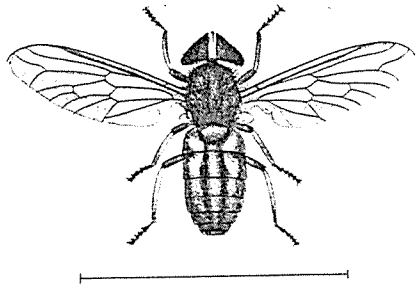
5. Tabanus crassus Walk. (♂)

6. Tabanus sanguineus Walk.

7. Tabanus rufidens Big.

8. Tabanus rufidens Big. (♂)

PLATE VII



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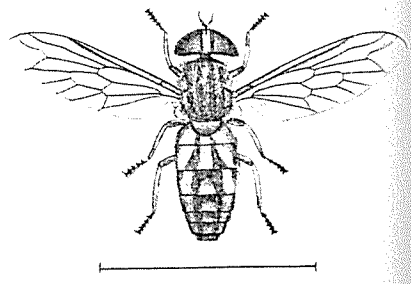

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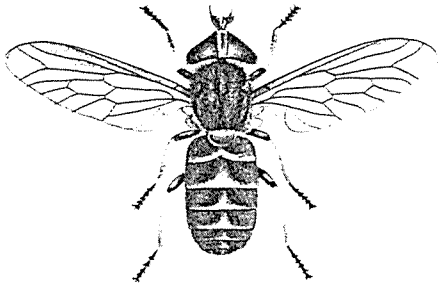

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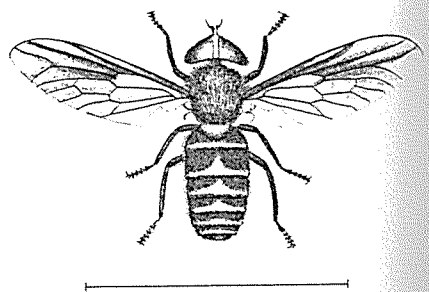

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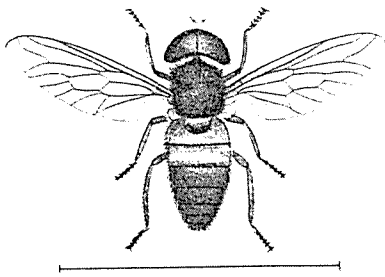

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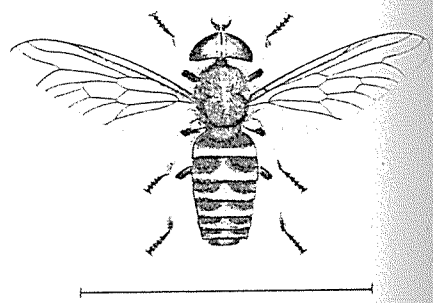

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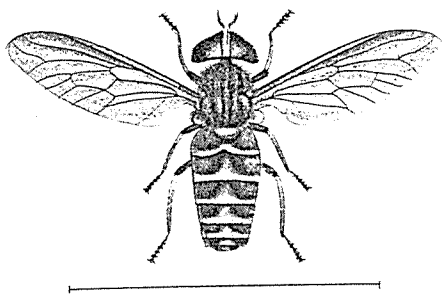

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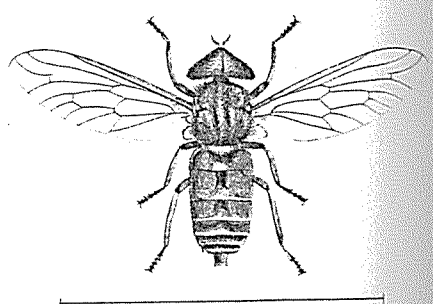

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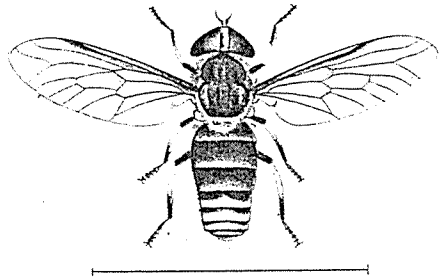
Explanation of Plate VIII.

1. Tabanus miyajima Ric.
2. Tabanus trigonus Coq.
3. Tabanus exoticus Ric.
4. Tabanus coquilletti Shir.
5. Tabanus chrysurus Loew.
6. Tabanus formosiensis Ric.
7. Tabanus perakiensis Ric.
8. Tabanus birmanicus Big.

PLATE VIII



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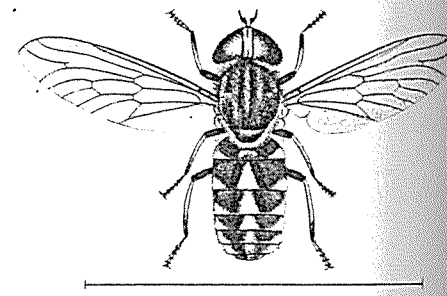

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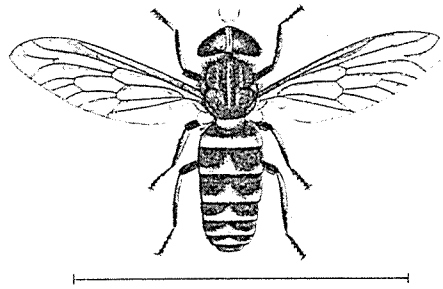

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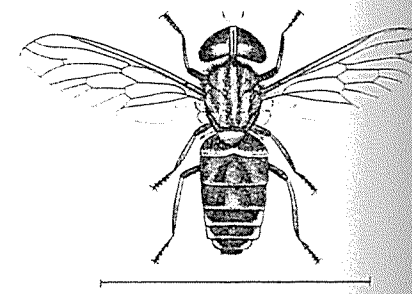

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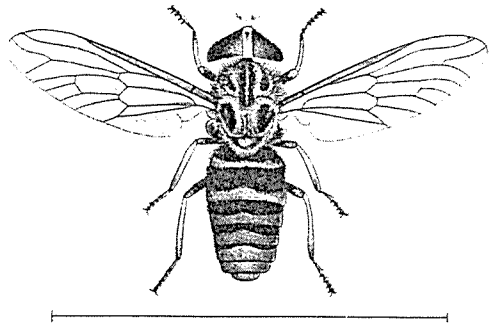

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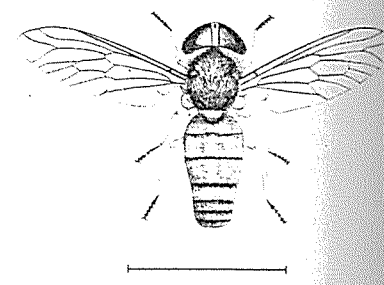

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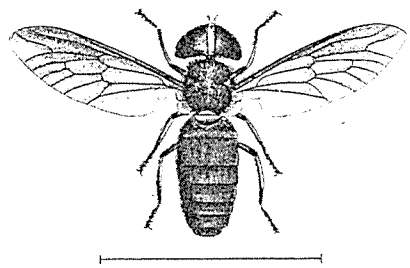

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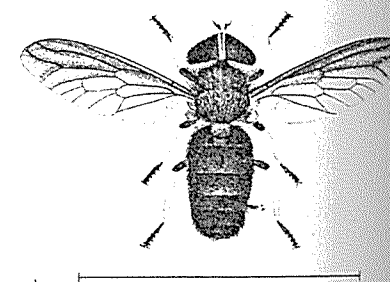

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T. Okuni del.

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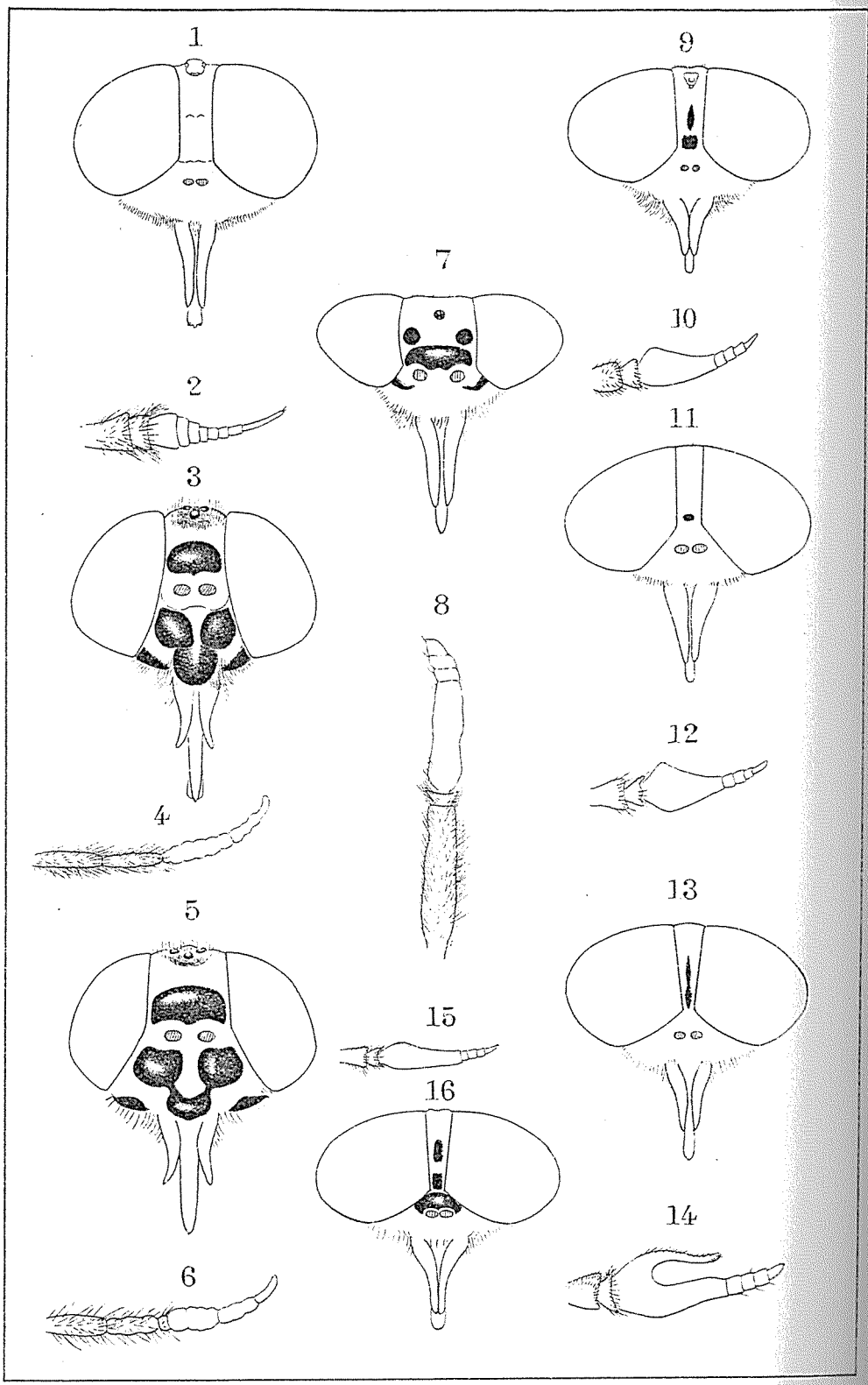
Explanation of Plate IX.

Fig. 1. Corizoneura yezoensis Shir. (n. sp.)
2. do.
3. Chrysops basalis Shir. (n. sp.)
4. do.
5. Chrysops nigricornis Mats.
6. do.
7. Haematopota formosana Shir. (n. sp.)
8. do.
9. Therioplectes hirticeps Loew.
10. do.
11. Atylotus bivittatus Mats.
12. do.
13. Isshikia japonica Big.
14. do.
15. Tabanus bicinctus Ric.
16. do.

PLATE IX



T. Shiraki del.

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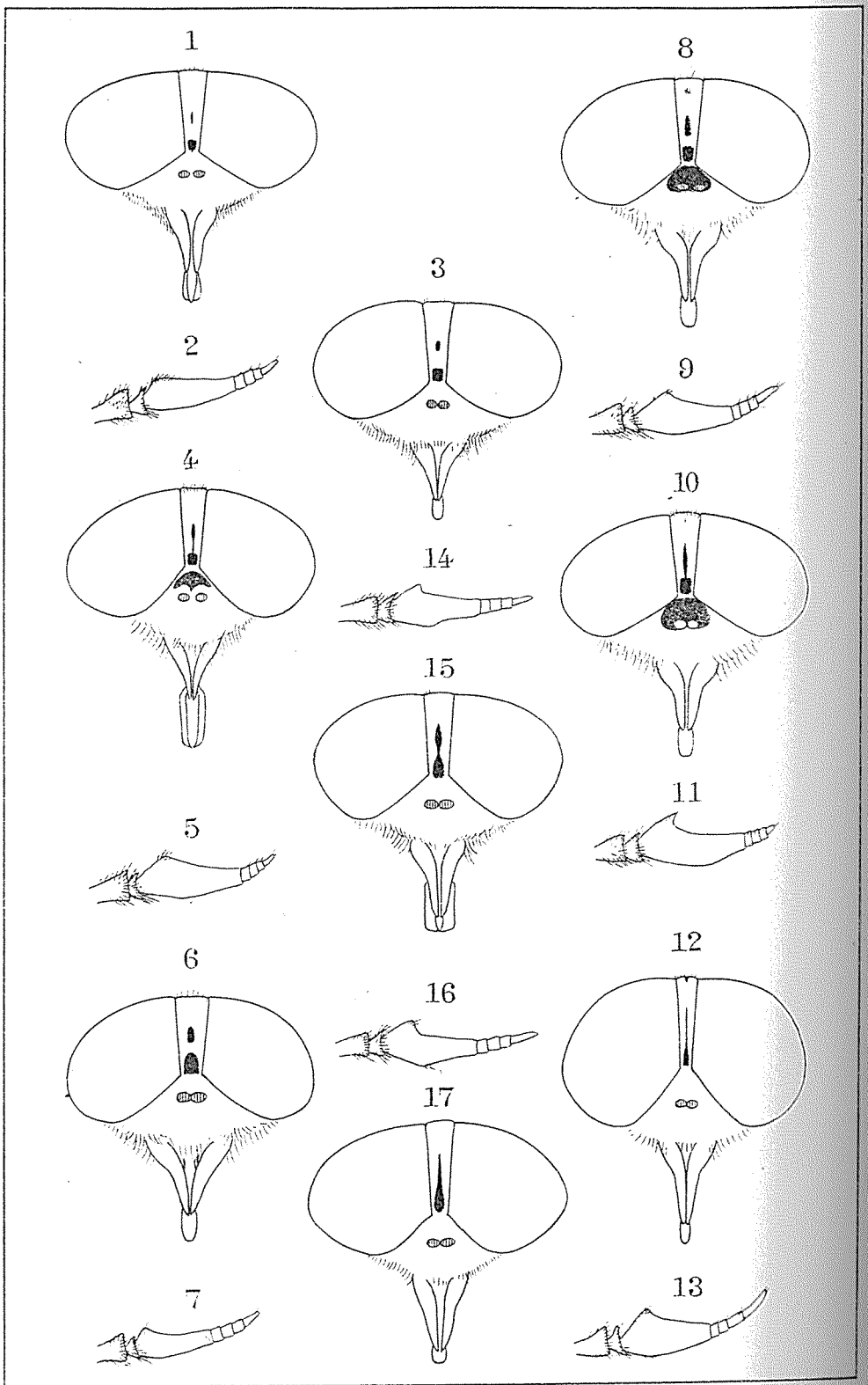
Explanation of Plate X.

Fig. 1. Tabanus kotoshoensis Shir. (n. sp.)
2. do.
3. Tabanus arisanus Shir. (n. sp.)
4. Tabanus sapporoensis Shir.
5. do.
6. Tabanus fulvimedioides Shir. (n. sp.)
7. do.
8. Tabanus iyoenais Shir. (n. sp.)
9. do.
10. Tabanus humilis Coq.
11. do.
12. Tabanus coquilletti Shir. (n. n.)
13. do.
14. Tabanus fulvimedius Walk.
15. do.
16. Tabanus amaenus lateralis Shir. (n. v.)
17. do.

PLATE X



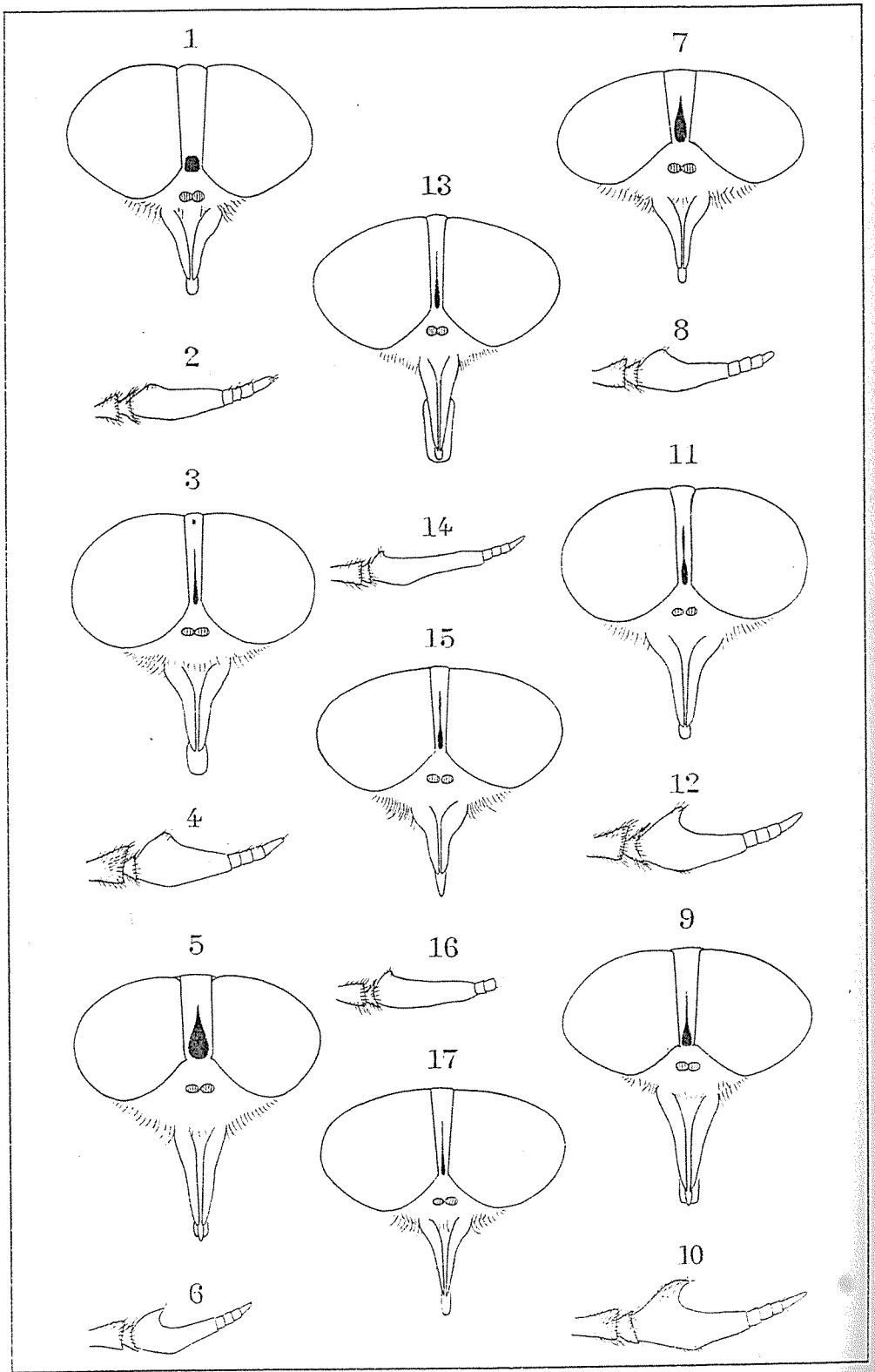
T. Shiraki del.

Litho. & Printer, Hoyeisha, Tokyo, Japan.

Explanation of Plate XI.

Fig. 1. Tabanus miyakei Shir. (n. sp.)
2. do.
3. Tabanus okinawanus Shir. (n. sp.)
4. do.
5. Tabanus sapporoenus Shir. (n. sp.)
6. do.
7. Tabanus takasagoensis Shir. (n. sp.)
8. do.
9. Tabanus trigonus Coq.
10. do.
11. Tabanus rufidens Big.
12. do.
13. Tabanus birmanicus Big.
14. do.
15. Tabanus perakiensis Ric.
16. do.
17. Tabanus formosiensis Ric.

PLATE XI



T. Shiraki del.